

MARCH, 1928

Annual Labor Saving Number

Railway Engineering and Maintenance



THE SUPER FAIR

for
Exceedingly Severe Creeping

CHICAGO **THE P. & M. CO.** NEW YORK

MONTREAL

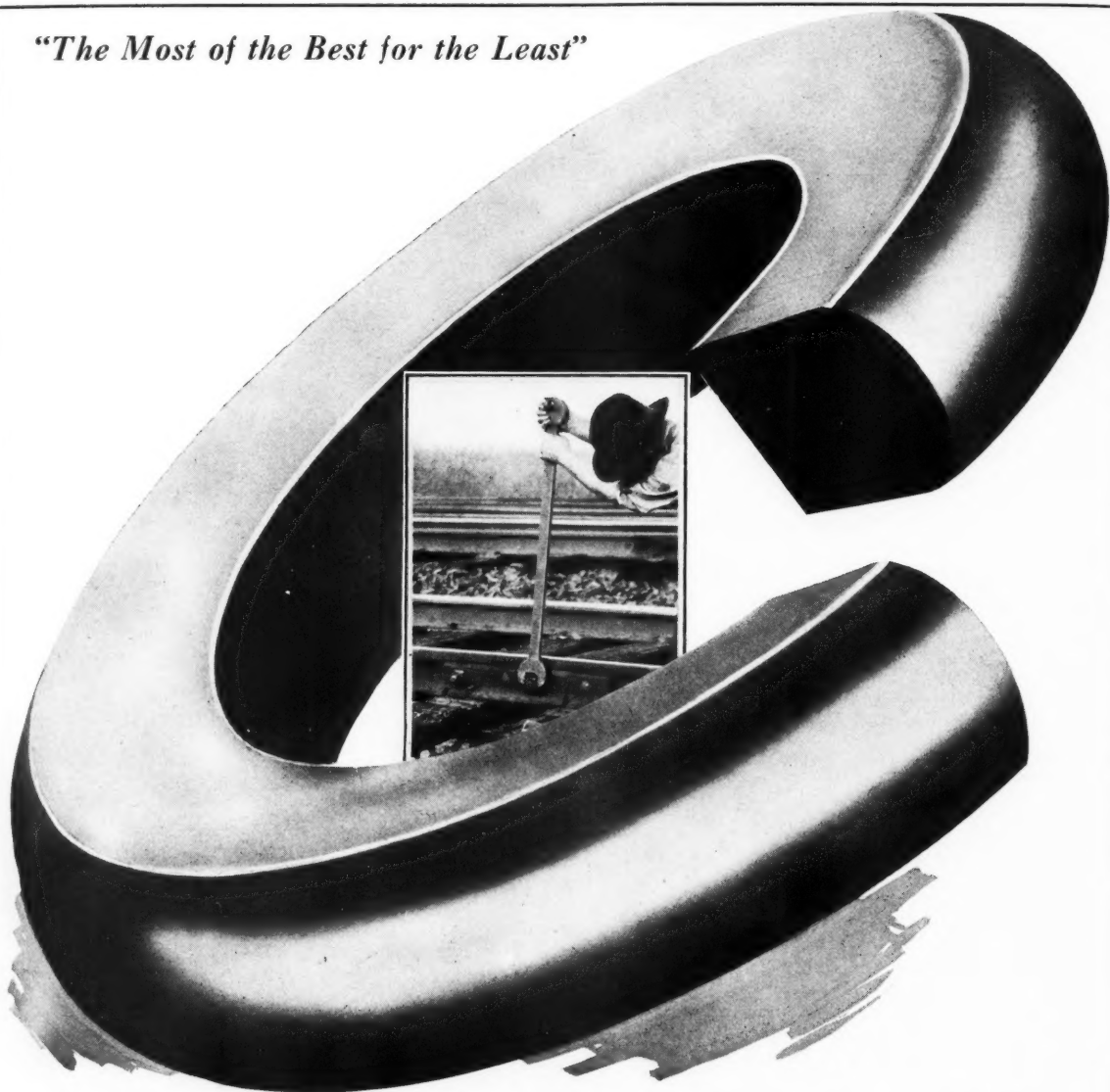
LONDON

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"The Most of the Best for the Least"



Let HY-CROME Handle the Job

THIS is the age of specialists and mass production.

Our specialty is HY-CROME Spring Washers, which eliminate the expensive methods of yesterday and insure positive rail joint security.

HY-CROME performance proves that our standard of design, materials and workmanship is perfect and our up to the minute production facilities enable us to extend immediate service at minimum cost.

Let HY-CROME guard your rail joints

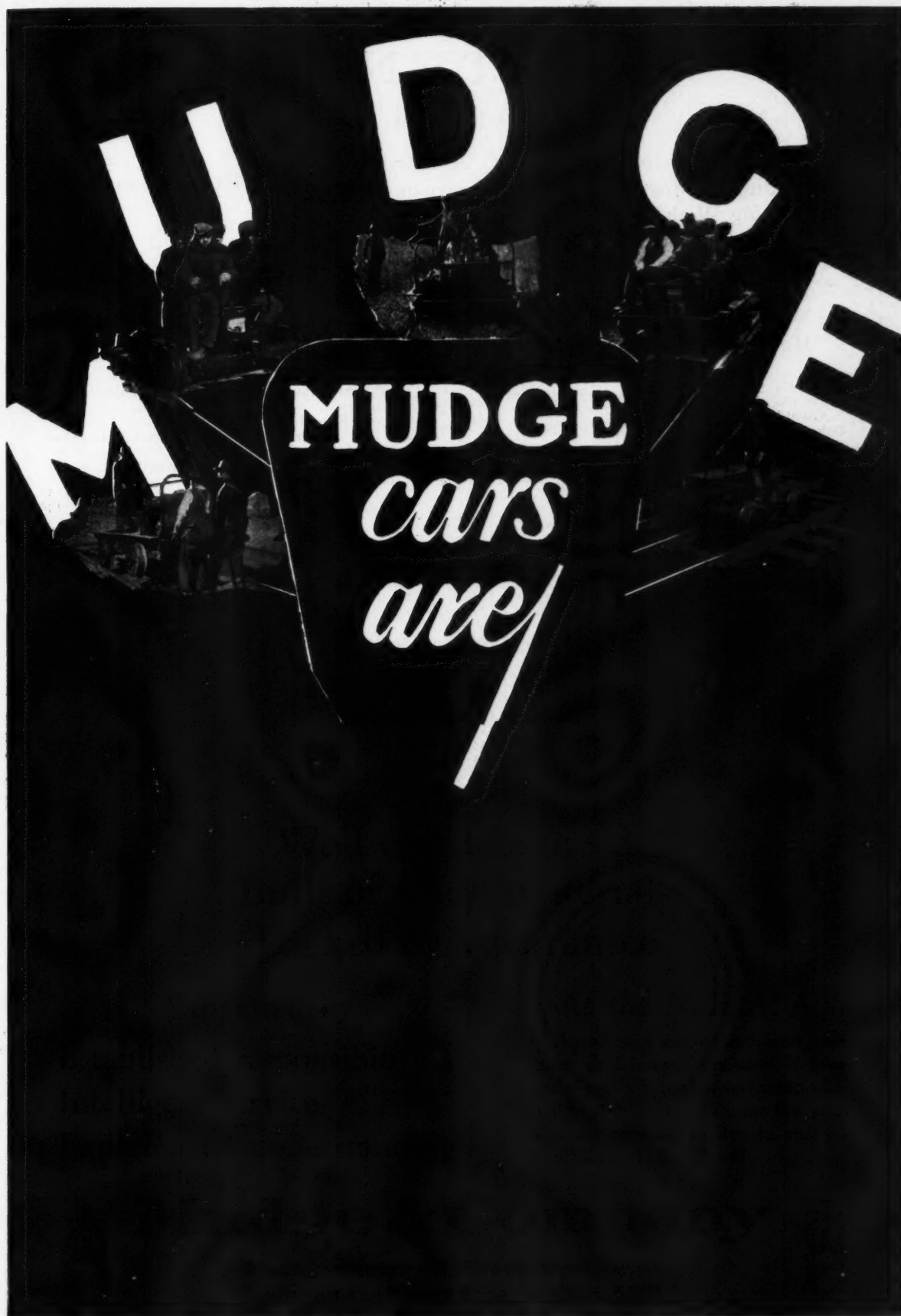
The Reliance Manufacturing Co.
Massillon, Ohio

HY-CROME

RAILWAY ENGINEERING AND MAINTENANCE
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Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

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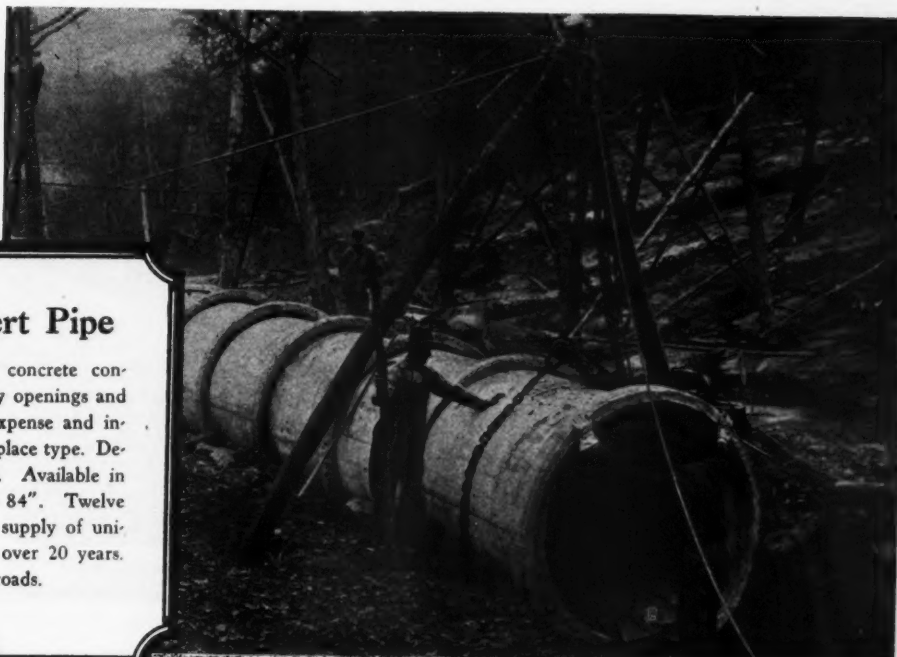
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Factory-Made REINFORCED CONCRETE PRODUCTS

Precast Culvert Pipe

offers the permanence of concrete construction for small waterway openings and cattle passes without the expense and inconvenience of the built-in-place type. Designed for railway loadings. Available in standard sizes from 18" to 84". Twelve factories insure dependable supply of uniform high quality. In use over 20 years. Standard on most leading roads.



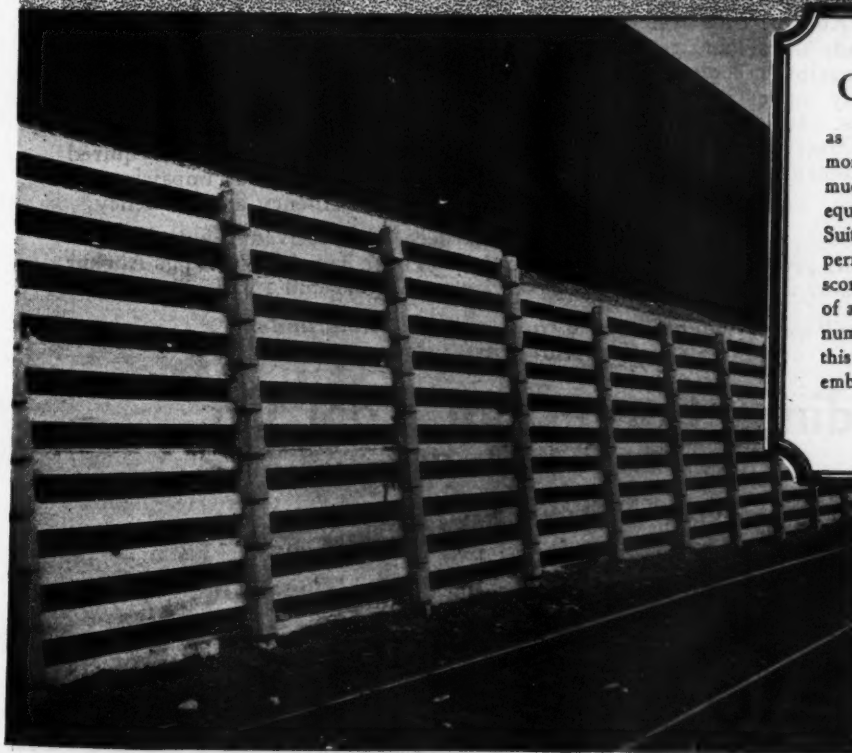
MASSEY

CONCRETE PRODUCTS CORPORATION, Peoples Gas Building, Chicago

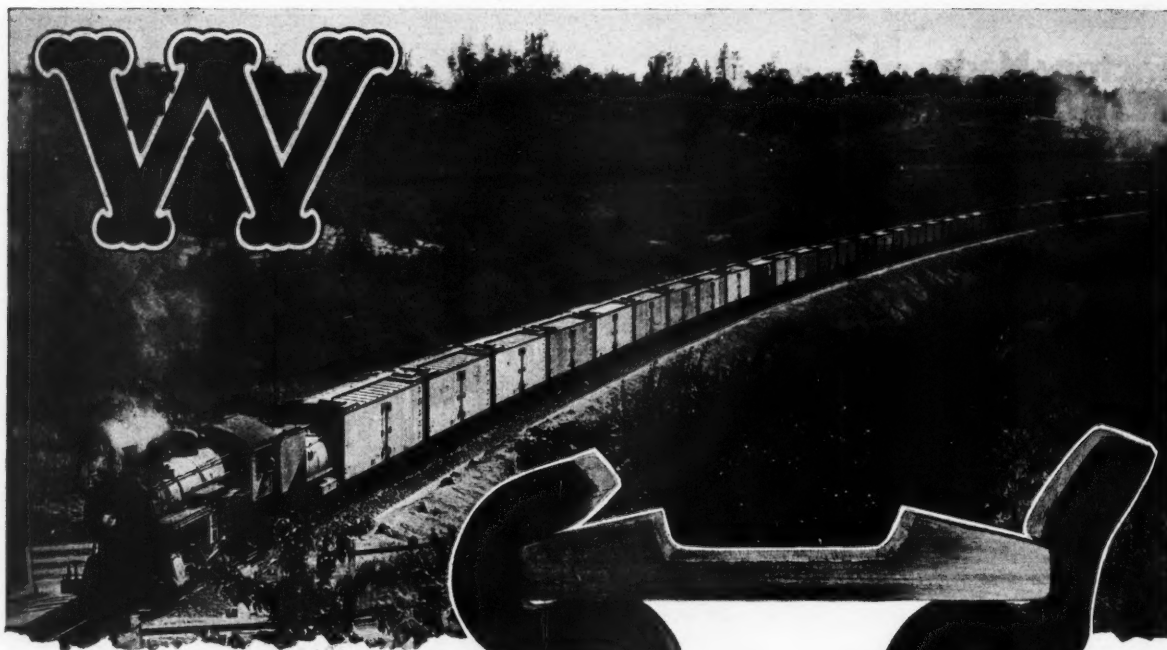
Sole Offices: New York, Adams, Manhattan 10; Eastern, 100 Broadway; Canadian Concrete Products Co., Limited, Transportation Building, Montreal, Que.

Concrete Cribbing

as stable and as permanent as a monolithic retaining wall. Requires much less concrete, no special field equipment and no skilled labor. Suitable for either temporary or permanent construction. In use on scores of railways for a wide variety of applications. Catalog supplement number 23 describes and illustrates this modern method of retaining embankments.



BOOTHS 54 and 55
N.R.A.A. EXHIBIT
MARCH 5-8



Holds Difficult Track from Creeping

See our exhibit
at the Coliseum
March 5-6-7-8
Space 171½

THE Woodings Rail Anchor, time tested on twenty-one railroads has demonstrated its ability to hold track against creeping efficiently and economically under the most difficult track conditions. It is considered one of the best anchors in service by some of the most prominent maintenance of way engineers in the country.

This one-piece anti-creeper, made of high carbon heat treated steel, grips on the rail base with enormous pressure at both sides by

its own resiliency. The very deep loop gives a splendid bearing surface against the tie and assures positive anchorage.

Application can be made quickly with very little expense. The anchor can be removed and reapplied as many times as required without breaking and without impairing its original strength, resiliency and efficiency.

Repeat orders are received regularly from railroads who have had the Woodings Anchor in service over a year and a half.

A test will quickly demonstrate their ability to hold under any traffic conditions.

Woodings Forge and Tool Co.

Works and General Sales Office
Verona, Pa.

WOODINGS RAIL ANCHORS

Clean ballast this new way/

THE unusual mobility and the patented positive steering device permits loading and unloading Northwests under their own power with ease. In a work train, these machines loaded on drop-end gondolas with a car ahead for screenings have cleaned between 3000 and 4000 feet a day.

And it is an all-purpose machine, easily converted to a dragline for ditching, or a shovel for all classes of excavation and grading.

With its crawler design it goes anywhere, crosses rails without danger of the treads jamming between the rollers, steers without rotating the cab, and is handled by only one man.

Let us tell you all about this machine.

NORTHWEST ENGINEERING CO.

The world's largest exclusive builders of gasoline and electric powered shovels, cranes and draglines

1701 Steger Bldg., 28 East Jackson Blvd.
Chicago, Ill., U. S. A.

**Booth
185
N.R.A.A.
Exhibit
Mar. 5**

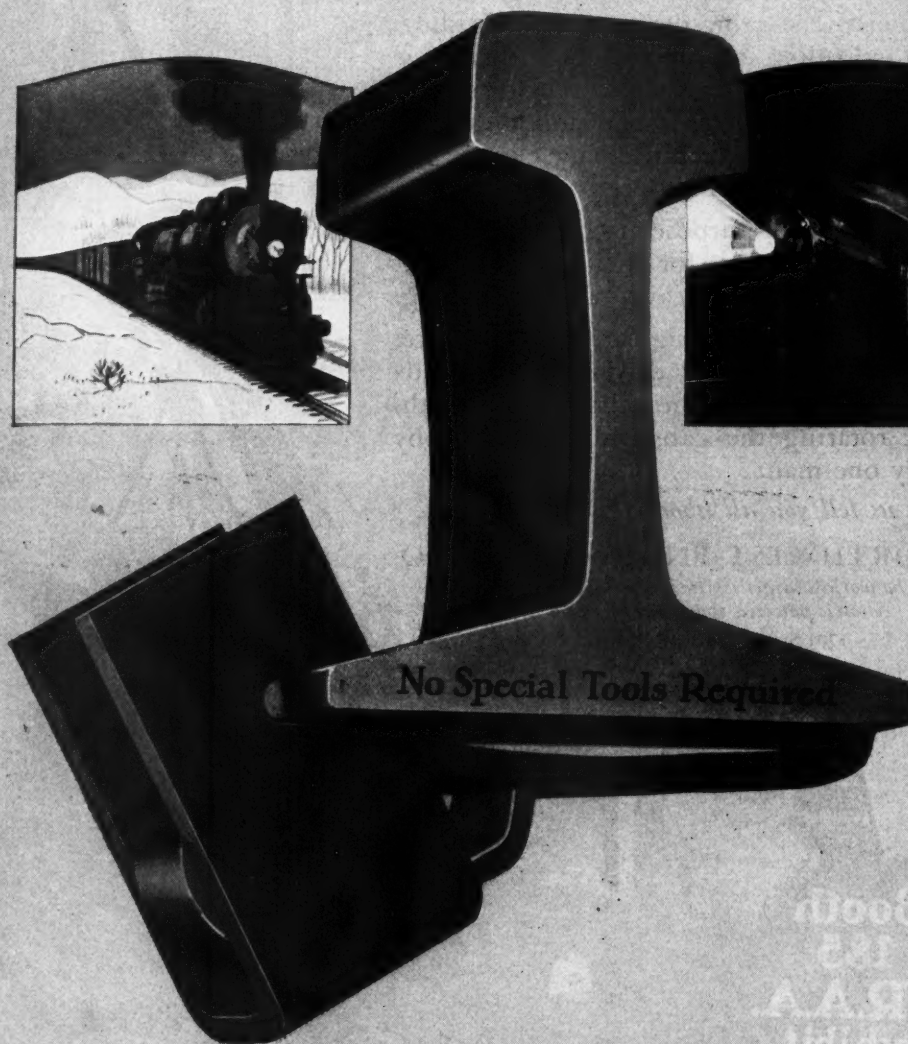
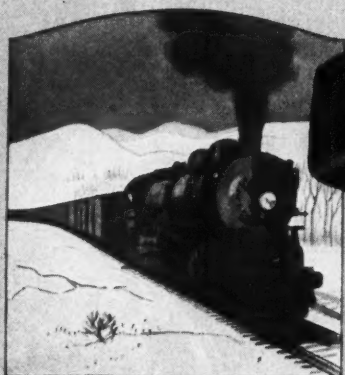
NORTHWEST

REAR
S-Gray

"STEAD" TRUE TEMPER RAIL ANCHOR

Day or Night, Summer or Winter, Single or Double Track,
STEAD ANCHORS always hold the rails safely.

Initial and Application Costs Low.



The American Fork & Hoe Company

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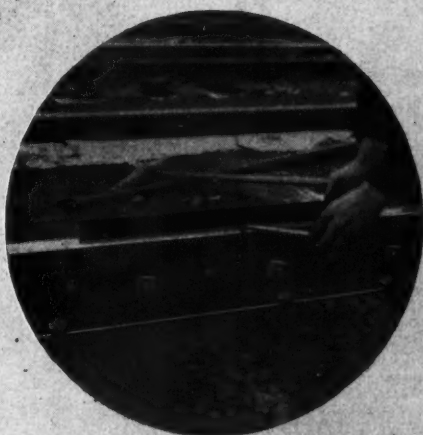
Representatives at

Boston, Detroit, Minneapolis, St. Louis, Denver and San Francisco

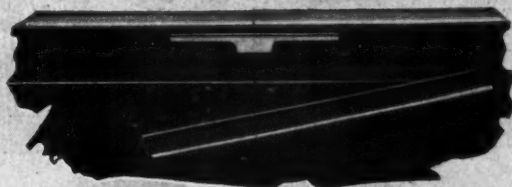
TRUE TEMPER TAPERED RAIL JOINT SHIM



The Remedy for low joints caused by wear



Low Joint conditions quickly and economically corrected by application of True Temper Tapered Rail Joint Shim



True Temper Tapered Shim in position with angle bar removed



Shim shown in position between rails and angle bar

The American Fork & Hoe Company

General Offices: Cleveland, O. Factory: North Girard, Pa.

District offices

Whitehall Bldg., New York, N. Y.—Railway Exchange Bldg., Chicago, Ill.

Representatives at

Boston, Detroit, Minneapolis, St. Louis, Denver and San Francisco

[You are invited to visit our booth, Nos. 235, 236, National Railway Appliances Association, March 5th to 8th inclusive, the Coliseum, Chicago, Ill.]



THE Fair

VISION

Supplying today's needs while foreseeing the new requirements of tomorrow is vision. It accounts for the fact that more than one-half of all the railway motor cars in use are Fairmonts. Today, and every day, Fairmont engineers are working upon products that may not be offered the railroad industry for several years. For example, the Fairmont MM9 was tested for more than three years . . . before it was considered worthy of the high confidence the railroad industry has in Fairmont products. The MM9 is a practical illustration of Fairmont "vision" . . . and "Performance on the Job" is a tribute to this same vision.

FAIRMONT RAILWAY MOTORS, Inc., Fairmont, Minnesota

District Sales Offices: New York Chicago St. Louis San Francisco
Washington, D. C. New Orleans Winnipeg, Canada

BALDWIN LOCOMOTIVE WORKS, Foreign Representatives

FAIRMONT PRODUCTS

Section Motor Cars A2—M2—S2—M14	Weed Burners C(M27)—B(M27)	Push Cars and Trailers T1—T2—T3—T20—T24
Inspection Motor Cars M19—MM9	Weed Mower M24	Roller Axle Bearings Ringscald—Axlsaver—Hyatt
Gang and Power Cars AT2—MT2—ST2	Ball Bearing Engines QB—PHB—PHA—QHB	Improved Wheels and Axles Power Track Cranes Safety Appliances



More track is tamped by air than by hand.

A Tie Tamping Compressor used for signal bending.

Air-operated drill used for drilling rails.

More ballast is tamped under each tie.

Air-tamped track is safer and more lasting.

Driving screw spikes with air-operated machine.

**Exhibit Spaces 206-209
at the
National Railway Appliances
Association Exhibit**

Paint sprayer puts paint into the corners and angles that are hard to reach.



A Tie Tamper Compressor furnishes air for sand blasting.



Running up nuts on new rail with pneumatic wrenches.



The Same Power Unit Is Used

Ingersoll-Rand Tie Tamper Air Compressors are such handy sources of reliable power that they are used with labor-saving air tools throughout the year. These outfits reduce expenses on many kinds of maintenance work.

For instance, pneumatic tie tampers cut the cost of track surfacing. Two men with tie tampers will tamp as much track as eight men with picks and tamping bars. In addition, more ballast is forced under the ties, making a safer, more uniform, and more lasting track.

Similarly, air-operated drills, wrenches, saws, and spike drivers are used to speed up rail laying. They reduce and lessen traffic delays.

In bridge and building work, pneumatic sand blasts, paint sprays, drills, hammers, and cement guns accomplish the awkward jobs that are often too difficult to be done economically with hand tools.

Air-operated machines also eliminate the drudgery of hand labor, improve the morale of the gangs, and reduce labor turnover. They "snap up" the entire maintenance department.

INGERSOLL-RAND CO., 11 Broadway NEW YORK CITY

Offices in principal cities the world over

For Canada Refer—Canadian Ingersoll-Rand Co. Limited, 10 Phillips Square, Montreal, Quebec.

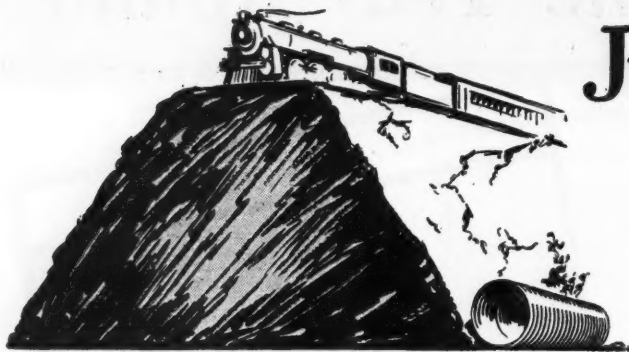
The compressor supplies air for riveters, chippers, or cement guns.



247-TT

Ingersoll-Rand

For *Quick* Culvert Placement



Just
jack
an

ARMCO
through

This

to

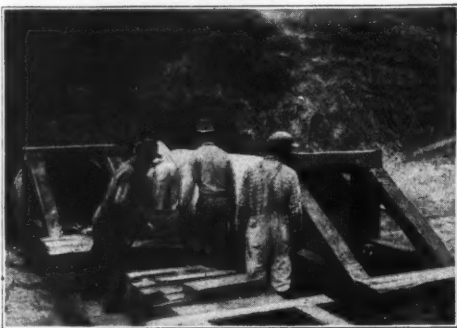
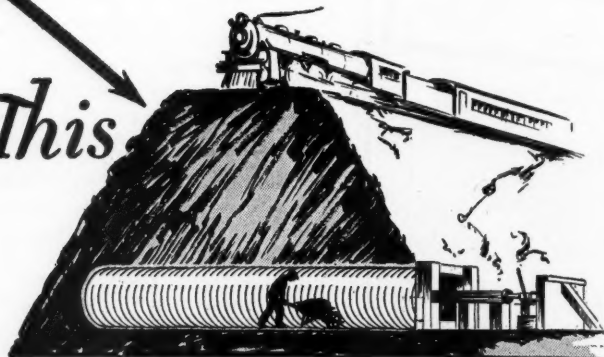
This

THE placement of culverts in existing fills is now made easy through the Armco jacking method. The work is done better at a substantial reduction in cost—savings usually run from 60 to 75 per cent of the open trench method.

There is no disturbance or interruption to traffic; no subsequent settlement of fill; no open trench or costly false work. You simply jack the Armco culvert through.

The method is applicable wherever an opening is required through an existing embankment—for additional drainage, for public utility conduits, for cattle passes or to replace a failed structure.

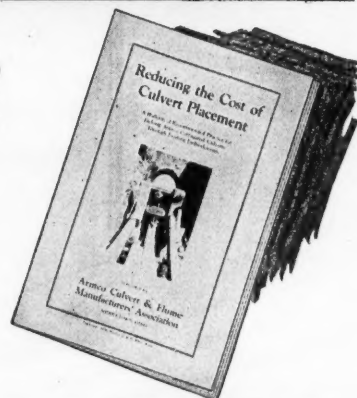
ARMCO CULVERT MFRS. ASS'N
MIDDLETOWN, OHIO



Actual photograph showing simplicity of the jacking method in culvert placement.

Get this Book!

"Reducing the Cost of Culvert Placement" tells how the Armco jacking method can be applied wherever openings are required under existing embankments—for new culverts, for conduits, for under crossings, for cattle passes.



ARMCO CULVERTS

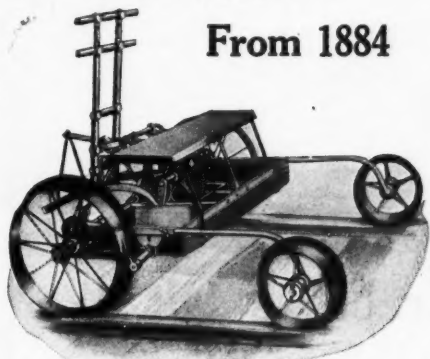
Predominant in use—because predominant in quality



From 1884

44
YEARS
of

To 1928



One of the first Kalamazoo service cars.



A modern Kalamazoo. No. 35-G Inspection Car.

“KALAMAZOO **means Service to you”**

Kalamazoo equipment has been a vital force in the building and maintenance of railroads throughout the civilized world.

KALAMAZOO RAILWAY SUPPLY CO.

Established 1884

Kalamazoo, Michigan

New York, St. Louis, New Orleans, Spokane, Portland, Ore., London, Johannesburg, Winnipeg
Chicago, St. Paul, Denver, Seattle, Havana, Mexico City, Vancouver, Montreal

KREOLITE



We Distill Our Own Creosote Oil

By so doing it is possible for us to insure to the purchaser a uniform pure product of any grade desired. We have treated hundreds of millions of feet of timber in the past 17 years without a single instance of decay.

Our several plants are located where it is possible to purchase solid Upland Mountain Oak to advantage.

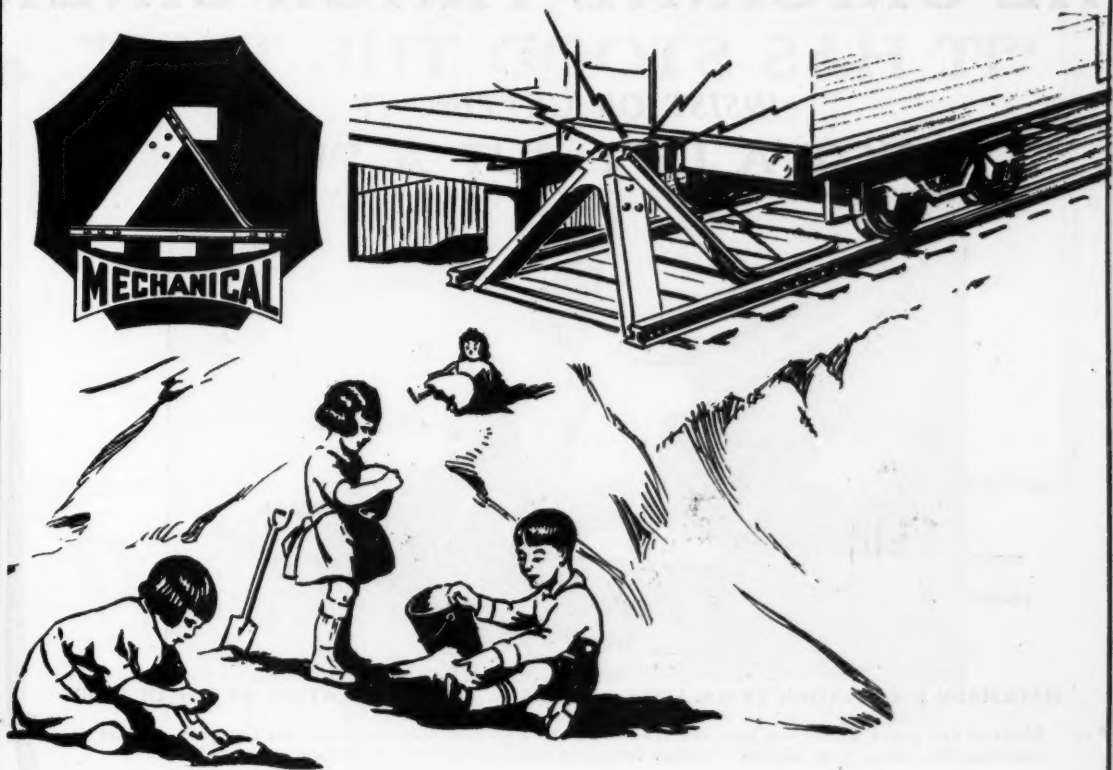
We specialize in framing timbers to your plan before treatment.

Enormous stocks of Cross Ties, Switch Ties, Structural Timbers and Piling, in all sizes, in Solid Oak or Pine, properly sticked and air seasoned before treatment, available for prompt shipment from Toledo, Ohio, or our Midland Creosoting Company plant at Granite City, Ill. (East St. Louis).

THE JENNISON-WRIGHT COMPANY, Toledo, Ohio

Branches in all Large Cities

R.R. TIES



It is the new heavier equipment that has to be considered

Make your preparations to stop cars at track ends with the new, heavier cars in mind. All other cars will be taken care of automatically. Even this extra heavy equipment cannot shake the

Improved DURABLE Bumping Post

Any single car getting beyond the end of a track may cause heavily expensive damage. For that reason the DURABLE has been designed and built to stop all cars.

None of the DURABLE erecting conveniences or other qualities have been sacrificed in this strengthening process.

It is just as simple in construction; all parts are fitted at the factory just the same way as before so that everything will fit in installing; there are only a few holes to drill in the running rails, no more; and the post is still just as easy to install in any weather, not a shovel full of dirt to turn.

And—the Improved Durable Post has shown in actual use and in actual working tests that it does stop—not retard—the cars. Railroads in all parts of the country are making it standard equipment—it is worth investigating.

The Mechanical Manufacturing Co.

Union Stock Yards, Chicago, Illinois

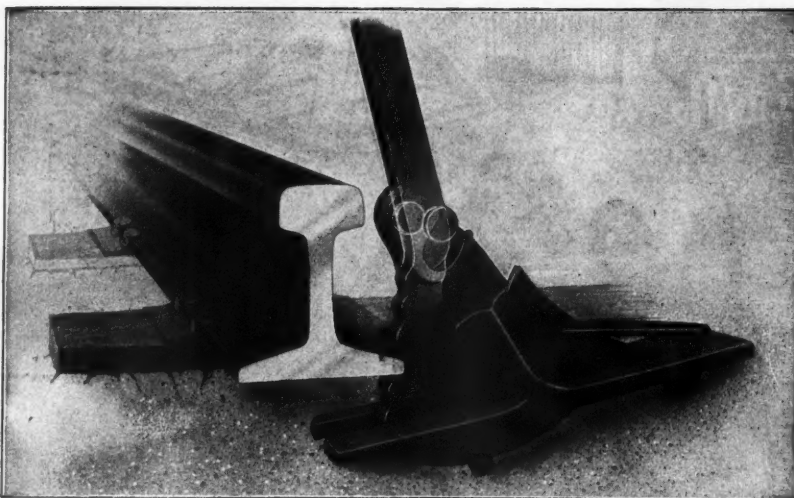
MECHANICAL

THE ORIGINAL TRACK LINER

"IT HAS STOOD THE TEST"

INSIST ON GETTING IT

NOT A LIFT BUT A PULL



HACKMANN COMBINATION TRACK LINER. NOTE THE TWO STEP FEATURE AT TOP OF BASE

Made of two parts, a two-step base and special heat-treated bar. Can make at least two pulls without resetting the liner. Your choice of either lining or tamping bar with each base.

THEY PAY
FOR
THEMSELVES
IN
ONE DAY'S
LINING



THREE TO
FIVE MEN
CAN DO
THE WORK OF
SEVEN TO NINE
MEN

HACKMANN DUPLEX TRACK LINER. NOTE THE TWO STEP FEATURE AT TOP OF BASE

Made of two parts, a base and removable fulcrum. Can make at least two pulls without resetting the liner. Used with ordinary lining bars.

NOW IN USE ON MORE THAN 100 RAILROADS

Hackmann Track Liner will do more than only line track. Can be used for lining frogs, switches, raising low joints and spacing ties. Can be used at end of switch ties when lining turnouts, puzzle switches and many other purposes.

Write for Instruction Sheets

THE HACKMANN RAILWAY SUPPLY CO.

Railway Labor Saving Devices

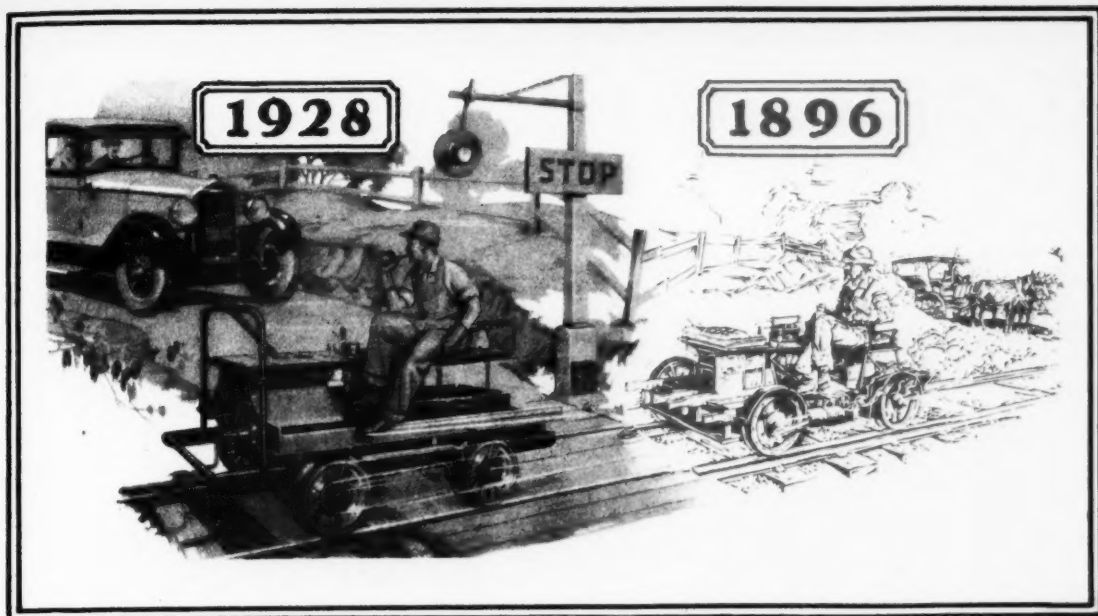
723 SOUTH WELLS STREET, CHICAGO, U. S. A.

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Railway Exchange Bldg.
Chicago

G. E. GEER
3436 Aldrich Avenue, South
Minneapolis, Minn.

BALDWIN LOCOMOTIVE WORKS
Foreign Representatives
Philadelphia, Pa.

THE HOLDEN CO., LTD., Canada
Montreal, Toronto, Winnipeg
Vancouver



Watch Sheffield —

and you watch motor car progress

The thirty-one years since Fairbanks-Morse built the daddy of all section cars have been a steady procession of pioneering steps.

Developments like the center load car, the water-cooled engine, the gear drive, the chain drive, the free running engine, the clutch drive, the two-cycle engine, the self-priming engine, the pressed steel wheel, and many others were first conceived in Sheffield cars.

Fairbanks-Morse developed a clutch that could not be burned out and thus made possible the Sheffield "44."

To build the peer of all section cars — the Sheffield "40-B" — Fairbanks-Morse adopted three-point engine suspension and many other principles of advanced automotive practice such as pressed steel auto-type frame.

These are the features that have given a *plus* value to the Sheffield line—the features that you find, in their highest development, only in Fairbanks-Morse cars.



FAIRBANKS-MORSE MOTOR CARS



First on the rails—and still first

FAIRBANKS-MORSE MOTOR CARS

New standards for trailers and push cars

Here is construction that puts the push car or trailer on an entirely new plane. It is construction that incorporates features ordinarily considered too good for this type of car, yet performance is proving that the higher standards are more than justified.

For the first time Timken Tapered Roller Bearings are found on push cars and trailers. Other evidences of advanced design are improved adjustable toggle brakes with greatly increased braking power and the use of two bronze-bushed loose wheels to facilitate handling.

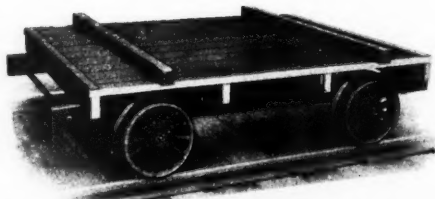
The double Timken bearings are mounted in dust-proof boxes and are conveniently oiled through holes in the deck which communicate with oil tubes reaching to the axle boxes. The superiority of Timken bearings for handling a combination of thrust and radial loads has been well demonstrated throughout the automotive field and is plainly an outstanding advantage in cars of this type.

Wheels are the well known 16-inch Sheffield pressed steel type with ground treads—the type that is used on Sheffield Motor Cars. Frames are of carefully selected, hard maple, and the sills are gained into each other and securely bolted.

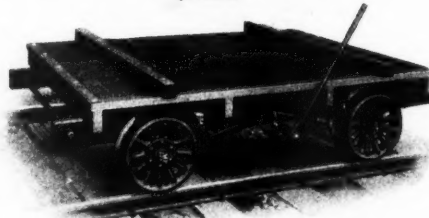
As a result of the many improvements the capacities of these push cars and trailers have been increased to 6,000 pounds for the "4-B," and 10,000 pounds for the "12-B," with the same liberal factor of safety that formerly applied to 4,000 and 8,000 pound ratings.

Cars are supplied with the different equipments illustrated here and are fully described in a new F-M Bulletin. Write for it.

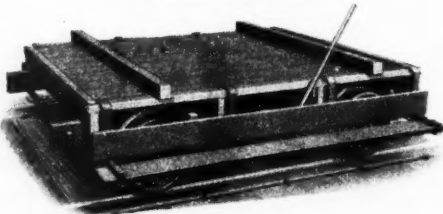
FAIRBANKS, MORSE & CO., Chicago



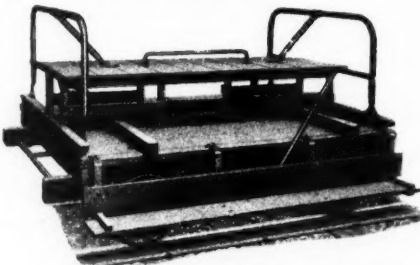
Stripped push car. Dump box sills on deck facilitate unloading frogs, rails, ties, etc., and transmit load forces directly to bearings without strains on frames



Trailer equipped with sturdy, powerful four-wheel brakes and safety coupler



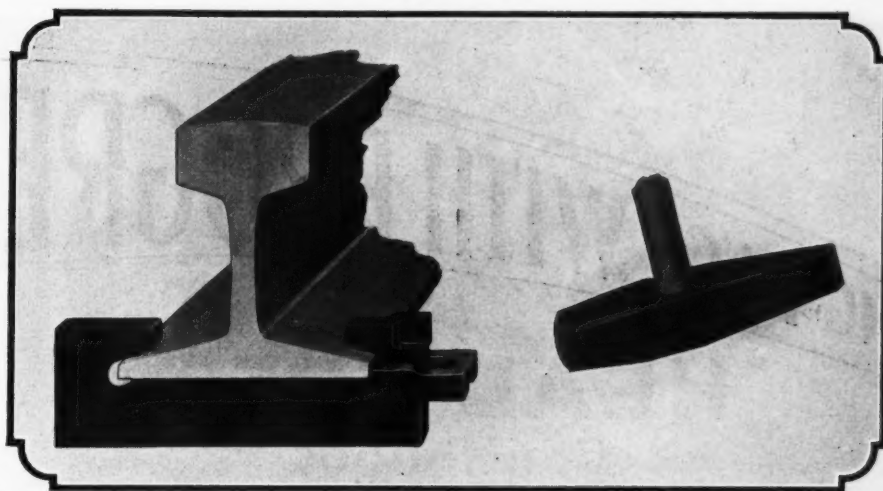
Trailer with side steps and brakes



Trailer completely equipped with rigidly built, removable seat top section, side steps and brakes

FAIRBANKS-MORSE PUSH CARS *and* TRAILORS

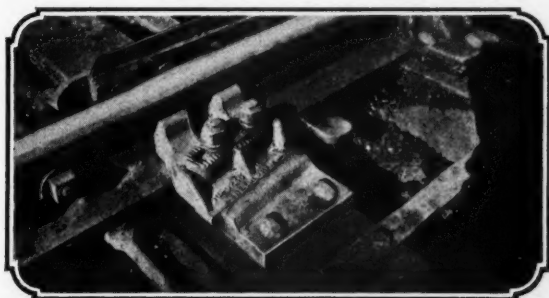




BETHCO RAIL ANCHORS

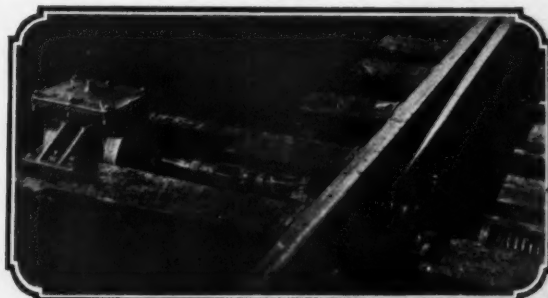
Bethco Rail Anchors are easily and quickly applied. They are slipped on by hand and secured by a few blows of a hammer, the entire procedure requiring but a few seconds. The large bearing surface against

the tie positively eliminates all danger of tie cutting. They hold equally well in either direction and will grip worn or corroded rails as well as new ones.



Improved Adjustable RAIL BRACE

The Improved Bethlehem Adjustable Rail Brace may be installed with a minimum of labor, as it is not necessary to cut the tie. Being strongly and sturdily constructed it is especially well suited to heavy service.



HYDRAULIC CHECK for *Spring Operated Switches*

The new Bethlehem Hydraulic Check for Spring Operated Switches will effectually prevent destructive hammering and consequent wear and tear on switch points. It may be set to operate in either direction, and is readily adjustable to vary the time of closing or to compensate for difference in the consistency of the fluid with change of seasons.

These and many other articles of Bethlehem Railway Track Equipment will be on display in the Bethlehem Exhibit at the National Railway Appliances Association, Coliseum, Chicago—March 5-8, inclusive.

BOOTHS 70½-72

BETHLEHEM STEEL COMPANY *General Offices:* BETHLEHEM, PA.

District Offices: New York Boston Philadelphia Baltimore Washington Atlanta Pittsburgh Buffalo
Cleveland Cincinnati Detroit Chicago St. Louis San Francisco Los Angeles Seattle Portland

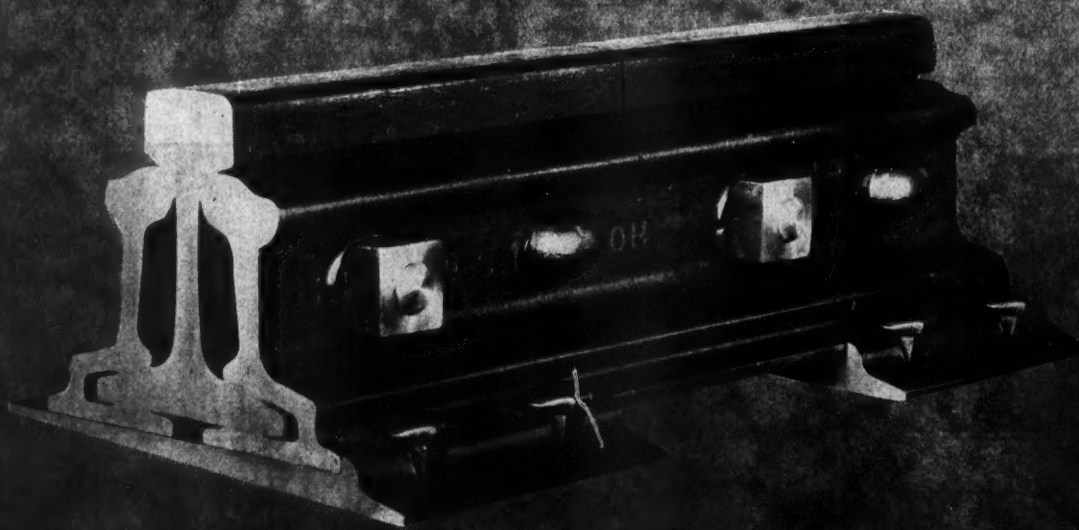
Bethlehem Steel Export Corporation, 25 Broadway, New York City, Sole Exporter of our Commercial Products

BETHLEHEM

HEAD FREE

Continuous

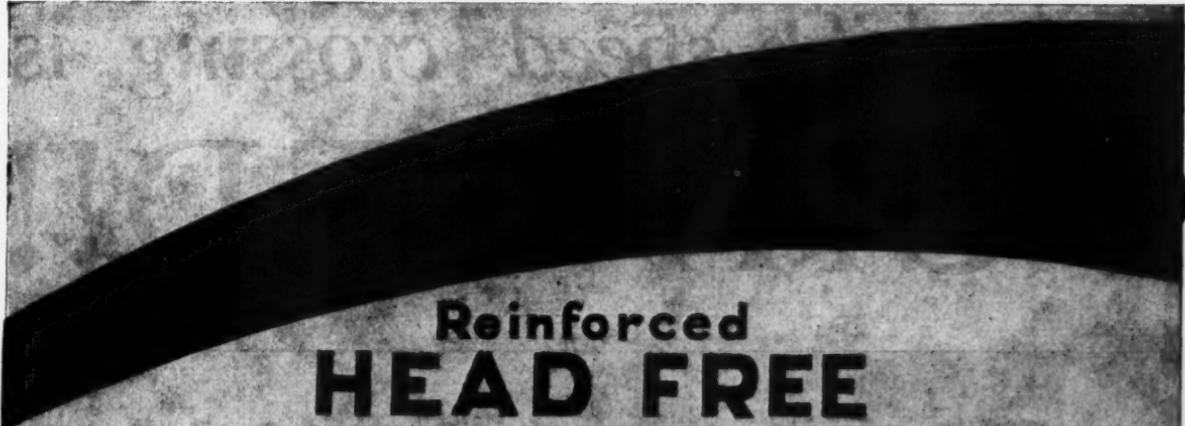
JOINT



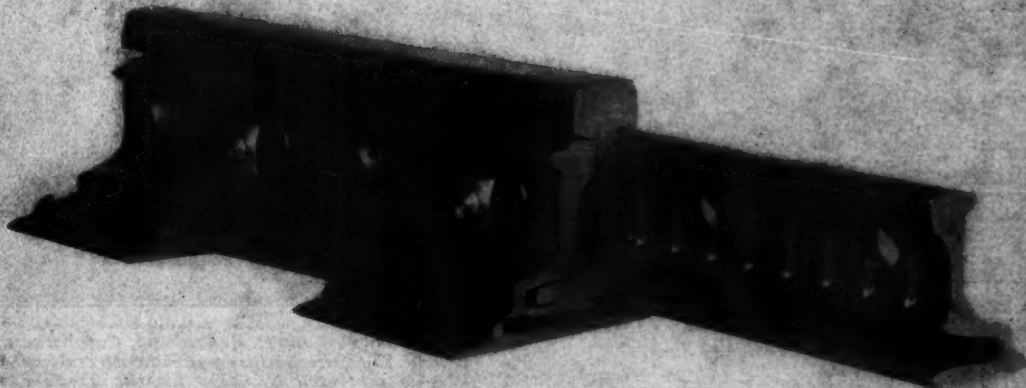
THE HEAD FREE FILLET BEARING AREA
can never be diminished.

A COCKED HEAD FISHING BAR
reduces the head bearing to almost a line.

The Rail Joint Company
165 Broadway, New York City



Reinforced
HEAD FREE
Continuous
JOINT



A RECENTLY COMPLETED RECORD

Under identical, heavy duty service,
130 lb. Head Free Joints and Heavy Angle Bar Joints kept
the rail in track **5 YEARS** and **2½ YEARS** respectively and
the Head Free Bars are still fit for further use on new rail.

BETTER THAN TWO TO ONE

The Rail Joint Company
165 Broadway, New York City

This high-speed crossing is GUARDED!!



CROSS SECTION
Scale 1/2\"/>

Cross section, showing an actual application. Carey Elastite Track Pavement consists of slabs and sections of rail filler, both made of fibrous asphaltic material that knits and heals under traffic.

Baltimore & Ohio R. R. Crossing, Cumberland, Maryland. The surface will remain smooth and level, because it is protected by Carey Elastite Track Pavement.

Also manufacturers of
Elastite Bridge Floor-
ing; Elastite Cable
Trunking—write for
information and in-
stallation photos.

IT is smooth, now, because it is new.
And it will **STAY** smooth, too,
because it is protected by Carey Elas-

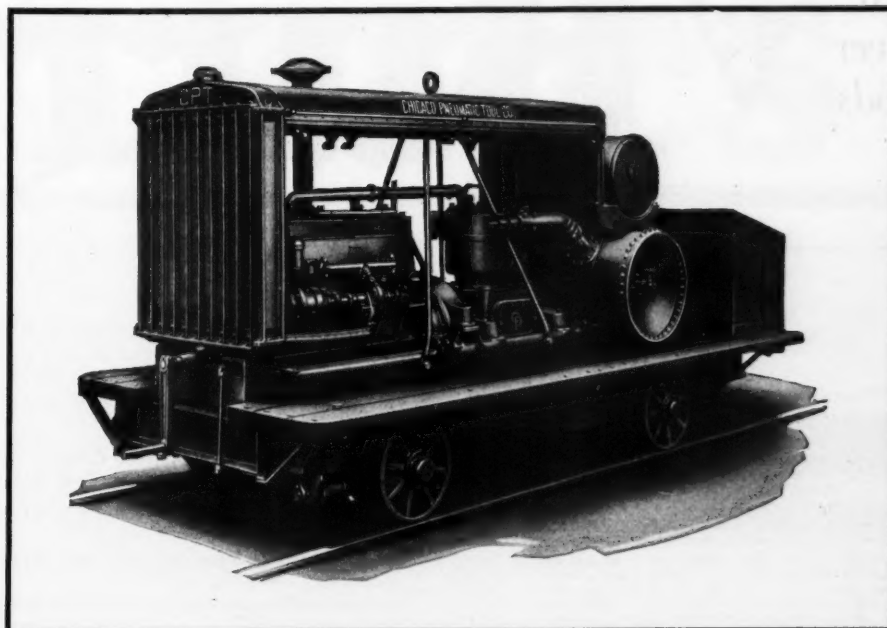
tite Track Pavement, the improved crossing material which knits and heals under train and vehicular traffic.

Its installation cost was moderate—common labor did the work, using ordinary tools. Its upkeep cost will be practically nothing—under the favorable track conditions shown in the photograph, it will require little or no attention. Ask us to tell you more about this modern crossing—about the remarkable pavement that guards it against weather and traffic. Write.

**Carey
Elastite**

THE PHILIP CAREY COMPANY
Lockland, Cincinnati, Ohio

TRACK PAVEMENT
"Knits and heals under traffic"



New

Ready to go—under its own power—to handle almost any railroad service job where compressed air is needed, the CP Self-Propelled Gasoline-Engine-Driven Compressor makes possible a new efficiency in railroad maintenance equipment. The standard CP Compressor with its famous Simplate Valve, Auto-Pneumatic Throttle and other exclusive features, is mounted on a truck frame carrying flanged wheels

with Timken roller bearings, transverse shifting wheels, a transverse towing winch and air-operated lifting jacks. The car is propelled at a speed of 12 to 18 miles per hour, depending upon the size. The compressor is furnished in sizes of 100, 160, 220 and 310 cubic feet per minute displacement. Bulletin No. 789 completely illustrates and describes this latest CP development and will be sent on request.

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Railroad Department

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Sales and Service Branches All Over the World

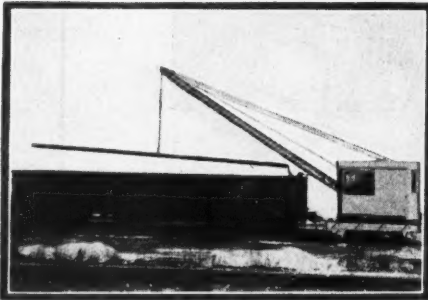


C-280

"It takes
a Burro
to deliver
the goods"



Burro



Burro Model 20 unloading 39 foot rail from gondola. The sides of this gondola are 4' 8" high, and the brake staff extends 6" above the sides. Note that the crane is coupled to the car and is used to propel the car. Because of its drawbar pull this Burro Crane can effect tremendous savings by eliminating use of work train or locomotive in a great many cases.



Note how the 6' 2" tail swing of the Burro Model 20 enables the crane to swing completely around when used on double track roads without any possibility of the rear end of the revolving deck fouling the adjoining track.

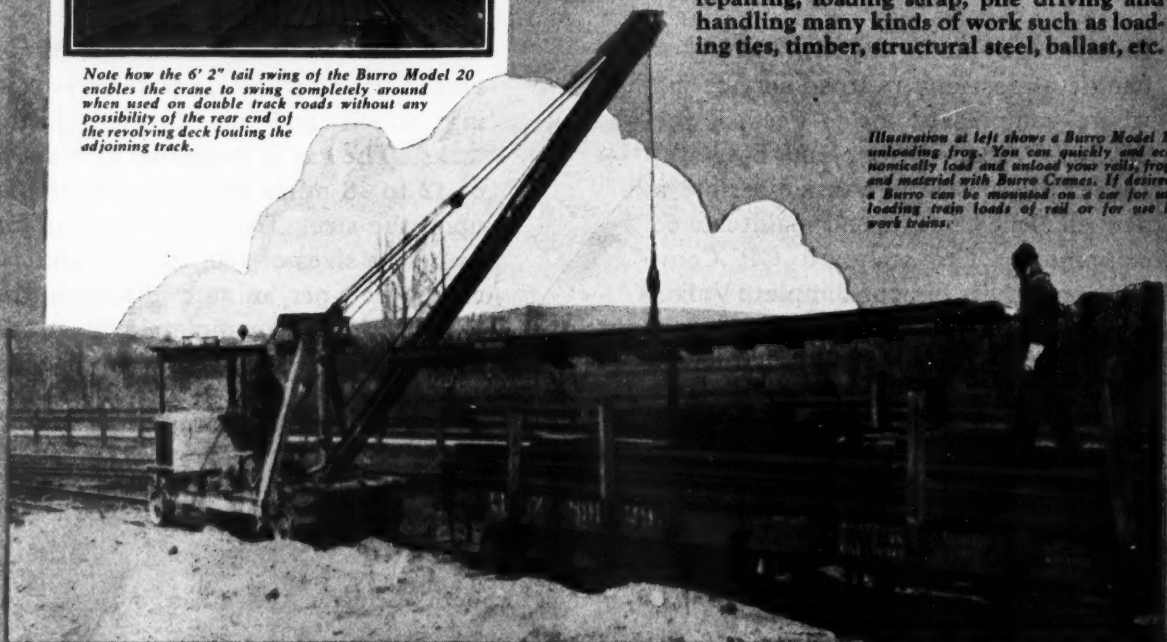
BURRO CRANES are effecting huge reductions in costs on many of the country's leading roads because of their ability to replace man power, reduce work train service, and in many cases eliminate the use of a locomotive.

In rail relaying alone Burro Cranes have more than saved their purchase price in 60 working days on some roads. Here's how you save by using a Burro for rail relaying:

- a Burro with an operator and 3 men replaces 20 to 24 tong men.
- a Burro will handle rail three times as fast as a gang of tong men.
- a Burro will handle the heaviest rail through a wide radius, eliminating the necessity of accurately spotting steel when it is being unloaded. This makes it possible to increase the speed of rail unloading, thereby reducing work train time.

Among the jobs now being done with economy and speed by Burro Cranes are rail relaying, hauling and switching cars, hauling men and material, cleaning cinder pits and loading, unloading and handling bulk materials with clamshell, handling metal with magnet, excavating, setting frogs, doing bridge and trestle repairing, loading scrap, pile driving and handling many kinds of work such as loading ties, timber, structural steel, ballast, etc.

Illustration at left shows a Burro Model 10 unloading frog. You can quickly and economically load and unload your rails, frogs and material with Burro Cranes. If desired, a Burro can be mounted on a car for unloading train loads of rail or for use in work trains.



Cranes

Reduce Work Train Service *with a Burro Model 20*

Be sure to see the motion pictures of the Burro Model 10 relaying rail, and of the Burro Model 20 in action, at our Exhibit, Booth 142, March Railway Show.

Steel Burro Cranes
are made in two following sizes:

Model C-F 10

180° swing; Capacity 5,000 lbs.
Travel Speed: 3 to 20 m. p. h.

Model C-F 20

Full Revolving; Capacity 10,700 lbs.
Travel Speed: 1½ to 20 m. p. h.
Tail Swing only 6' 2"

Illustration at right shows Burro Model CF-20, with 51 h. p. motor at 1,100 r. p. m., 33 ft. boom and fully enclosed steel cab. A Model 20 Burro can load or unload rail from gondola car coupled to the crane, and because its overall height is only 11' 0" it may be shipped on car without dismantling. A one man crane that will do the work of twenty men on many jobs. Write for complete detailed specifications.

"It takes a Burro to deliver the goods"

Cullen-Friestedt Co.

Main Office and Plant:
1300 South Kilbourn Avenue
CHICAGO

IN many cases a Model 20 Burro Crane can handle its own cars, thus effecting a huge reduction in work train service and in the use of a locomotive.



MC WILLIAMS "MOLES"

*Removes dirt at the rate of
2½ Cubic feet every 17 seconds.*

The Mole is the only machine in railroad use today that thoroughly cleans ballast from end to end of ties in the inter-track space—the only machine that automatically excavates, conveys and cleans dirt from ballast, returning cleaned ballast to the road bed in one continuous operation—the only machine that clears trains on all tracks while in operation.

The "Mole", in fact, is the simplest, most economical method of cleaning ballast ever developed.

The savings effected make it well worth investigating by any progressive railroad official.

RAILWAY
MAINTENANCE
CORPORATION
Pittsburgh, Pa., U.S.A.



RAILWAY MAINTENANCE CORPORATION,
PITTSBURGH, PA., U.S.A.

ADVANTAGES

of the

Lundie Tie Plate



See it
at Space 90½

Holds track to rigid gauge under every traffic condition. Plate does not move on the tie.

Insures maximum tie life. There is absolutely no cutting into the ties due to the absence of any destructive ribs.

Under traffic the plate seats itself uniformly and develops a hardened glazed wear resisting surface on the tie.

Safeguards against mechanical wear, lowers maintenance costs and assures maximum return from your investment in ties and cost of treatment.

The Lundie Engineering Corporation
285 Madison Avenue, New York
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LUNDIE

TIE PLATE



"AMERICAN" Pumps for Hydraulic Elevator Service

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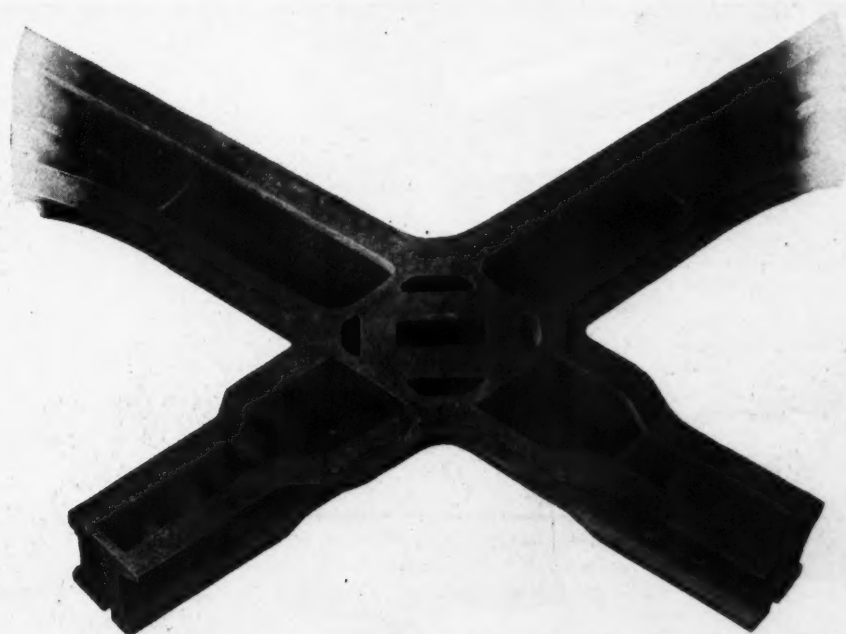
"AMERICAN" centrifugal pumps are standard equipment for many industrial uses. The installation above was made in the Philadelphia and Reading R. R. Company's freight house in Philadelphia. The two pumps, mounted on one base with a motor between, operate in series, the unit being used to activate a hydraulic elevator.

The unit is designed to have a capacity of 225 G. P. M. when operating against a total working-pressure of 200 lbs. per square inch, at 1750 R. P. M.

The motor used is one of 50-H. P.

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The New *Wharton* Solid Manganese Steel Crossing

Patented July 6, 1926

***Scientifically Designed and Constructed
To Stand The Severest Service in Track.***

We are much gratified at the interest that is being taken in this Crossing.

Why not give ?
it a trial

***Wharton-O'Brien Pull and
Lock Rods***

***Wharton Insulated and Non-
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WHEN corrugated culverts are made of Toncan Copper Molybdenum Iron, they are better prepared to resist corrosion.

Acid waters and unfriendly soil conditions shorten the life of the ordinary culvert. But Toncan Iron has the added protection of copper and molybdenum to help it combat corrosion.

Culvert replacement is too expensive to take a chance on anything but the most resistant material.

Where permanence is needed, as in corrugated culverts, Toncan Iron affords the greatest assurance of long life.

CENTRAL ALLOY STEEL CORPORATION, Massillon, OHIO
World's Largest and Most Highly Specialized Alloy Steel Producers
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BUDA No. 619 HEAVY DUTY Motor Car

4-Wheel Brakes—
Alemite Lubrication

Two or Four Wheel Final Drive

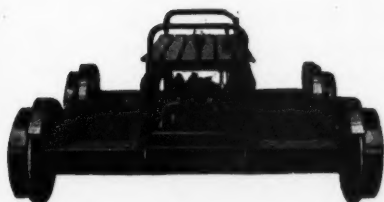
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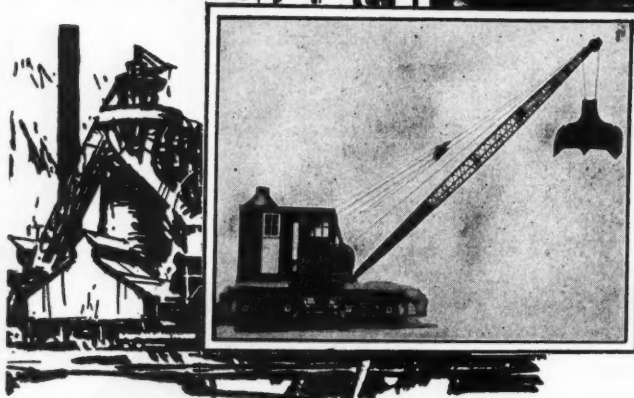
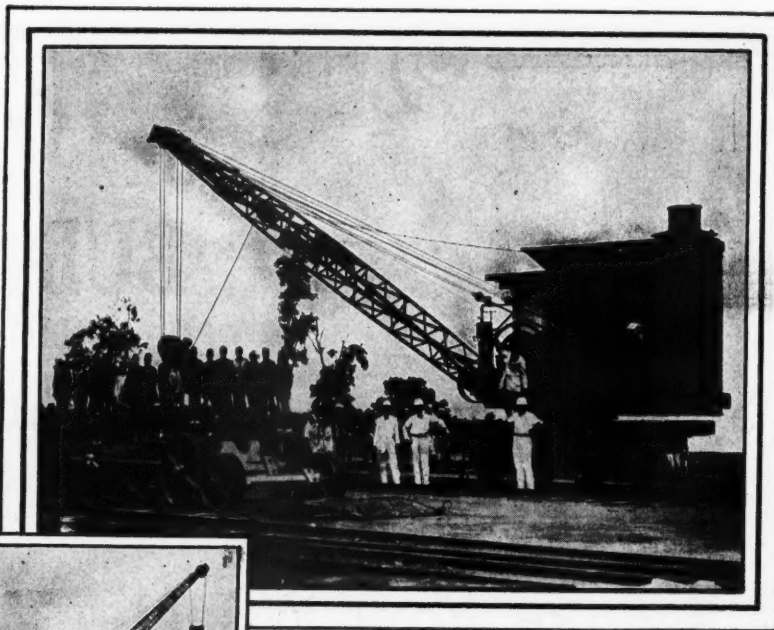
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If you could hire all the laborers you wanted at a per capita cost of a few cents a day, there might be some reason for not considering the use of an Industrial Brownhoist. Yet, in India, where this very condition exists, the Tata Iron & Steel Company have used these locomotive cranes since 1914.

People buy cranes only on a dollars and cents investment basis. And it is only because Industrial Brownhoists do give the lowest cost per ton of material handled that thousands are in use today.

Equally effective on bucket, hook, and magnet work, an Industrial Brownhoist will handle all kinds of materials and go anywhere to do it.

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Rebuild Rail Ends

by the

TELEWELD PROCESS

*A reliable means of welding
by electricity*

*A new plan of rail
maintenance*

*Workmanship
guaranteed*

*Responsibility
fixed*

*Definitely
priced*

Over a period of four years under main line traffic, 175,000 joints have been rebuilt by the TELEWELD PROCESS on four transcontinental railroads.

The TELEWELD equipment is flexible and self-propelled. It is moved rapidly over the rails with no interference to train operations. While operating it is set off in the clear of traffic.

The work is completed "A MILE AT A TIME" by extending operations over a half-mile of track each way from each set-off.

Pre-heating of the rail is unnecessary as the heat is localized, and instant fusion of a specially processed metal, which will outlast the original rail, is accomplished by the TELEWELD PROCESS.

The surface of the joint is ground perfectly level by efficient high-speed grinding machines of special design.

"A MILE AT A TIME"



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REDUCE YOUR SHOVEL TAMPING
GANG to 25% of present size.

TAMP MECHANICALLY, insuring absolute uniformity and maximum speed.

OBTAIN BETTER TRACK at astounding reduction in costs.

A working demonstration is now in progress at the Municipal Pier, Chicago, and may be seen until March 15.



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Because—it represents years of conscientious effort to give steel users better products—it represents control of manufacture from the mining of the ore to the finished product—it represents the work of experienced metallurgists, the pride of skilled workmen in their craft—it represents a friendly spirit of service and cooperation. Carnegie Rails and high carbon, oil quenched Angle Bars bear this name. It guarantees your satisfaction.

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of long-
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service*



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Makers of Old Glory, Liberty and Victory Brands



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ond growth northern ash handle, and the perfect balance that workmen prefer. O. AMES has been the standard of shovel quality for more than 150 years. Catalog illustrating and describing all sizes and types will be sent you on request.

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Now Available in Air, D. C. and A. C. motor drive

The "WOLF" Portable Timber Sawing Machine

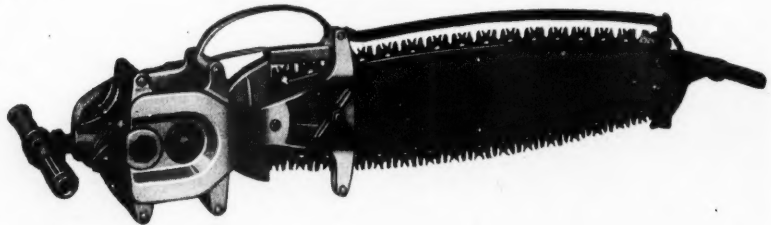
The successful operation of the "WOLF" Portable Timber Sawing Machine in 110 or 220 volts, 60 cycle, 3 phase A.C. and the continued call for the service of this equipment where this current is not available, has led to the development of the air motor and D.C. motor drive. Full details on request.

Performs accurately all the services of hand cross-cut saws at least five to ten times as quickly with less physical effort and labor turnover. Successfully serving over one hundred users in the railroad, mining, marine, timber treating, general construction and other fields. Names on request.

At the National Railway Appliances Exhibition at the Coliseum, Wabash Avenue and 15th Street, Chicago, Illinois, March 5 to 8, 1928, the "WOLF" Saw will be in operation and all three types available for inspection.

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Special General Electric designed for this service, dust proof and water proof (to a depth of two feet). Operates on 110 or 230 volts D.C. Capacity 24" diameter timber, weight approximately 100 lbs.



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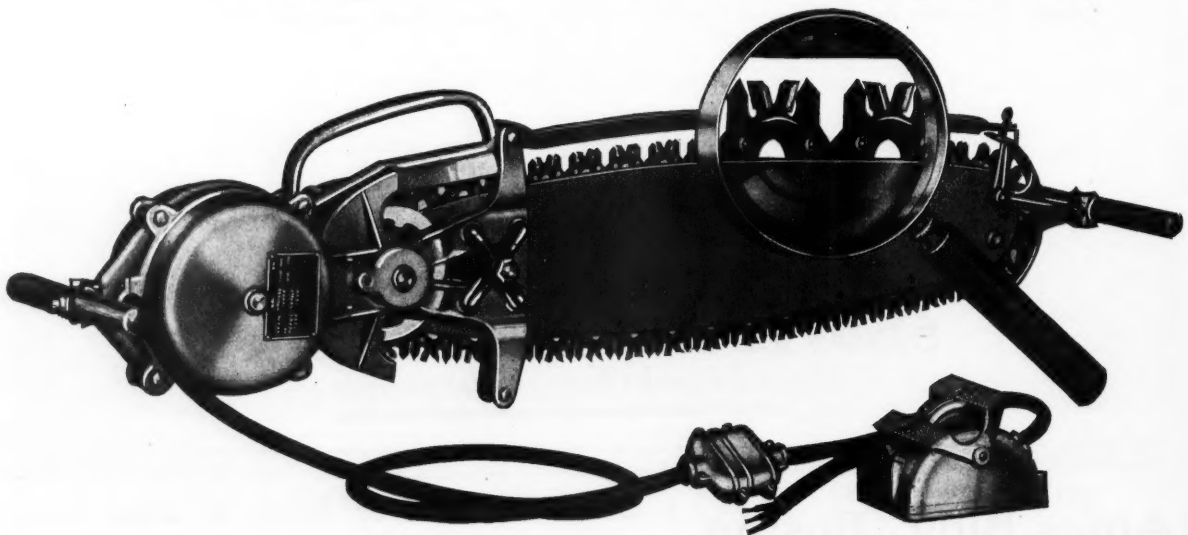
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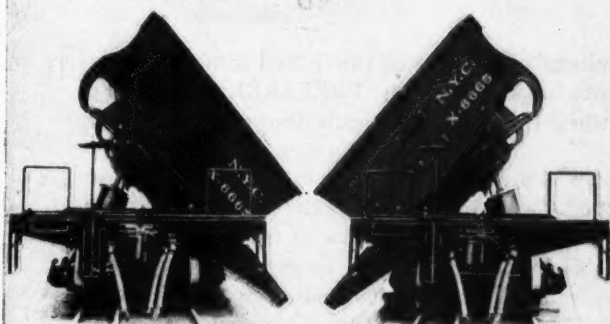
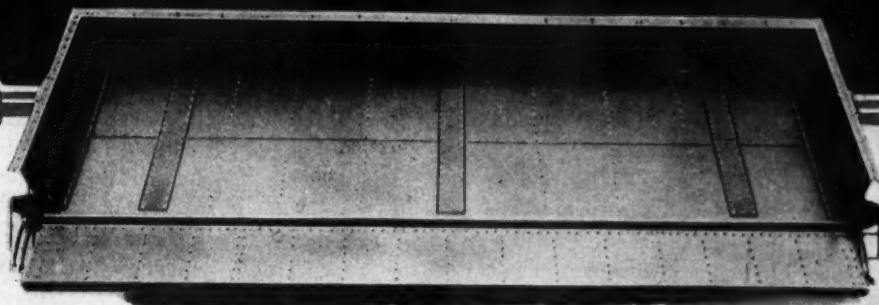
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Special Westinghouse designed for this service, dust proof and water proof (to a depth of two feet). Operates on 110 or 220 volts 60 cycle 3 phase A.C. Capacity 24" diameter timber, weight approximately 90 lbs.



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This Magor, 30 cubic yard, 50-ton capacity air dump car can be dumped automatically to either side. The car attains a fifty degree angle when in full dumped position, assuring complete discharge of any load clear of the track ballast.

A special valve mechanism permits the dumping of an entire train, a single car or any number of cars, irrespective of their location in the train.

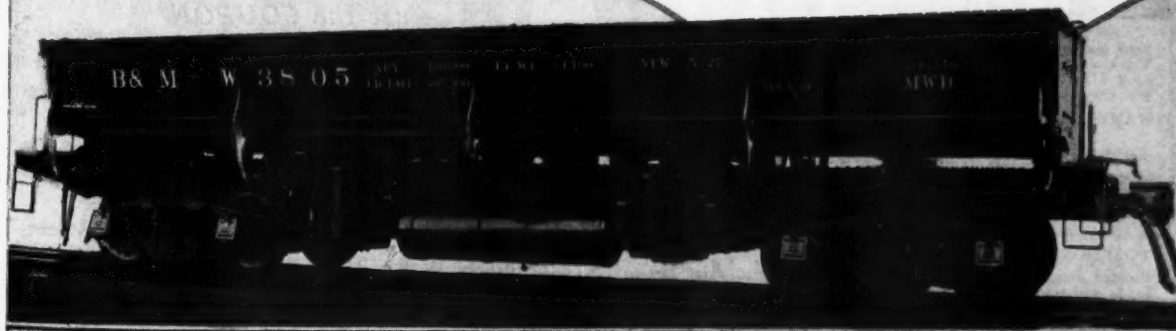
Multi-Purpose Car

THE new Magor Automatic Dump Cars are designed not alone for construction work and handling materials at terminals, but particularly to meet the need for a general service car which can be adapted for general maintenance work and at the same time suitable for regular revenue service.

They are designed so that the car body has complete and stable support at all times during transit on the center sill of the car under-frame. It is impossible for the cars to dump prematurely or while in transit.

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TRACK AND TURNOUT ENGINEERING

By C. M. KURTZ

Mr. Kurtz has written this book for the railroad engineer from the result of twenty-five years' practical experience.

Track and Turnout engineering is of practical value to every man to whom the business of track layout is an everyday problem. The young engineer or transitman, puzzled (or perplexed) by track-work problems should have this book. Division Engineers of Maintenance of Way Department would do well to see that all their subordinates in both field and office were provided with copies.

The problems shown are taken from actual practice and the mathematical treatment outlined and demonstrated is tried and practical treatment.

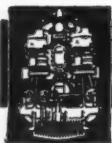
A. R. E. A. definitions of track, frog, switch, and turnout, crossing and yard layout terms are listed, and the **PREFERRED NAMES** of parts for split switches, frogs, etc., are clearly shown in illustrations.

Original tables, now in print for the first time, to facilitate the computation of connecting track layouts involving the location of turnouts from either inside or outside of curved tracks, or from tangent tracks, should prove valuable to students as well as experienced engineers who appreciate the value of short-cut methods, and realize the importance of having a large body of information for ready use in compact form. Trigonometrical function tables, both logarithmic and natural, and may other useful tables supplement the text.

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M-W RAIL CAR AIR COMPRESSORS ON THE PENNSYLVANIA SYSTEM



M-W Rail Car Units are made in four sizes, varying from 110 to 330 cu. ft. displacement, for the operation of from 4 to 16 pneumatic tie tampers.

The Pennsylvania Railroad System, recognizing the importance of maintaining solid roadbeds on their terminal divisions, find M-W Rail Car Air Compressors—with their advanced engineering features—a valuable help in speeding up this work.

A few of the important M-W Features are: Gasoline engines with 25% reserve power—complete force feed lubricating system in both engine and compressor—Worthington Compressors, equipped with Laidlaw Feather Valves—Counterbalanced Crank Shafts—Electric Starter Units—Rail Cars equipped with bevel gear reduction drive intact from compressor crank shaft to air cooled, ball-bearing friction clutch on propeller shaft—Increased speed on the rail in "forward" or "reverse"—simple derailing system.

Complete Catalog (Bulletin No. 306) on request

USE M-W PORTABLE AIR POWER FOR TIE TAMPING

METALWELD, INC.

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Dealers in all principal cities

Metalweld-Worthington

Portable Air Compressors



SMOOTHER ROADBEDS LOWER MAINTENANCE COSTS

What Does Price Tell You When You Buy Fence?

PPRICE almost never is a reliable indicator of true fence economy. Even with the best materials and the latest improvements in fence manufacture, your fence will be doomed to a premature end unless it is properly erected. No economy there! And certainly there's no saving when cheap materials are employed, precluding long life from the very start.

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Call a Cyclone Representative

Cyclone representatives are trained to know fence. They start in the factory and work through every department. They also erect fence on the job. Every Cyclone salesman has built his knowledge of fence on this sound foundation. He knows fence from start to finish.

It takes time, men and money to develop a fence service organization such as Cyclone maintains — the most complete in the world. There's a Cyclone representative near you. Call him for a consultation, day or night. Compare values — know your fence before you buy. Write, phone or wire nearest offices, without obligation.

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Fencing for
residences, estates,
playgrounds,

The Mark of
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schools, factories,
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all kinds.

Property
Protection

CYCLONE FENCE COMPANY

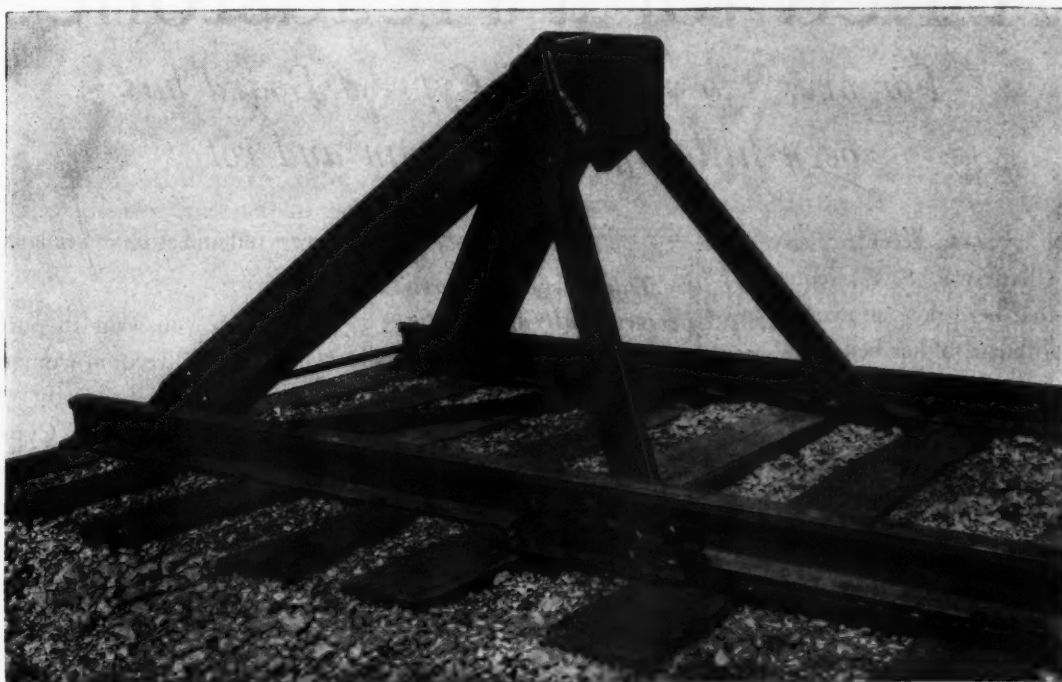
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When you buy a Type W Post for a track you are through buying posts for *that* track.

We base this statement on the fact that with over 1500 Hayes Type W Bumping Posts put in track during the past three years not one has been destroyed and scrapped.



Hayes

Hayes Track Appliance Co., Richmond, Indiana



A Bed for a Headstone!

*For over 150 years this Cypress Board has
been little affected by rain and rot*

IN 1770, an eccentric lady of Charleston, S. C., requested that her grave be marked by the footboard of her bed.

Her judgment has now been justified, for the letters on the board have remained legible long after nearby stone inscriptions were effaced.

Because it continually affords such durability as this, millions of railroad ties are made of Tidewater Red Cypress. Shipbuilders use it in enormous quantities. More acid and water tanks are made of it than any other lumber. Many houses built of it are over two hundred

*Tidewater Red Cypress
is especially adapted for*

Passenger Station
Construction

Freight Sheds and
Warehouses

Platform Construction

Conduits for
signalling systems

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—Cattle Cars—Refriger-
ator Cars

Yard Fencing

In short, any use where
long life and absolute
freedom from repairs are
essential.

years old and still in excellent condition.

Whenever you want to purchase long life and freedom from repair at moderate cost, specify "heart grade Tidewater Red Cypress." This Wood Eternal brings upkeep down with a thump. To give generations of service, it doesn't even have to be painted.

Complete information on this wood for industrial and home-building uses will gladly be sent on request. Southern Cypress Manufacturers Association, Department RE-3, Jacksonville, Florida

Specify

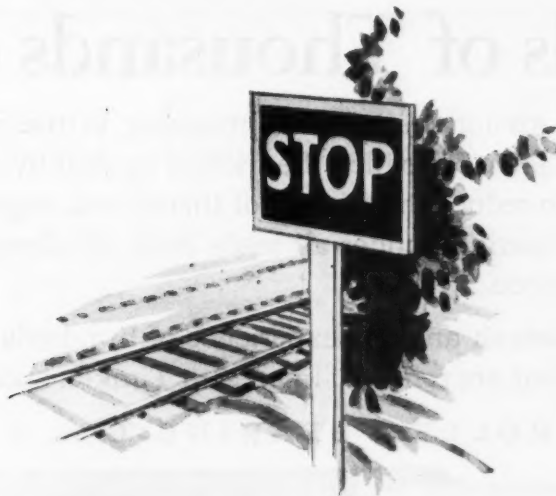


TIDEWATER RED



CYPRESS

THE WOOD ETERNAL



Why railroad executives are turning to DUCO* for finishing maintenance of way equipment

RAILWAY men are turning to Duco (special formula for brush application) for finishing all classes of maintenance of way equipment. Here are the reasons:

1. Duco dries quickly, producing a smooth, hard, durable film. Dust, dirt and cinders cannot become imbedded in it.
2. Duco is cleaned easily. Just use soap and water, or kerosene, or wipe clean with a dry rag. No cleaning compounds of any sort are needed. After cleaning, equipment finished in Duco looks exactly like new again.
3. Duco has greater durability than old type finishes. Extremes of climatic conditions—intense hot and cold weather—do not affect Duco. Hence, far greater periods between re-finishing. Hence, saving in upkeep costs.

**Special formula for brush application*

4. Duco is easy to apply. Any workman familiar with painting can apply Duco.
5. Duco colors are permanent. Where old type finishes fade out to a dull, indistinguishable monotone, Duco keeps its original color throughout the lifetime of the finish.

Duco (special formula for brush application) successfully solves the problem of finishing for

Switch stand targets	Mile posts
Highway crossing signs	Destination signs
Whistling posts	Gas motor cars

Duco comes in convenient one-gallon containers, with friction top cans: lids are easily removable and easily replaceable. Duco is also recommended for all classes of signal equipment. Railway executives are invited to send for additional data on Duco. If you say so, a representative will call.



E. I. DU PONT DE NEMOURS & CO., Inc.
RAILWAY SALES DEPARTMENT,
Parlin, N. J.

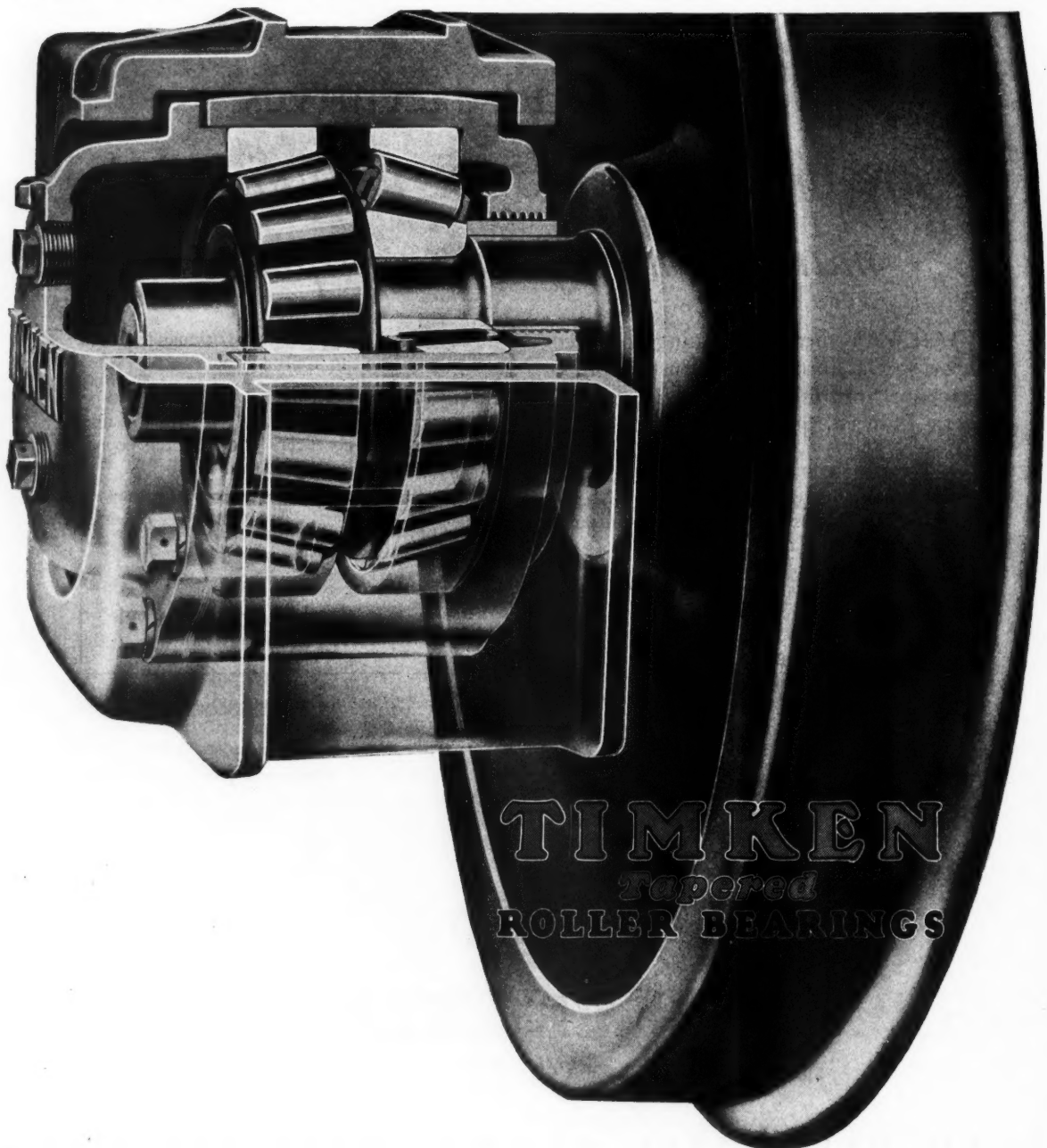
DU CO HELPS SELL RAILWAY TRANSPORTATION

Hundreds of Thousands of Miles

Timken Bearings are giving the broadest meaning to the railroad anti-friction movement. If it is valuable to reduce the friction caused by radial load, it is that much more valuable to reduce the friction of thrust and angular loads. Timkens are fully anti-friction bearings under all loads from all directions. That is what assures utmost endurance.

Years of relentless research and the experience of hundreds of thousands of car miles under all conditions are reflected in present Timken success on entire trains.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO



PERMANENT CONCRETE PRODUCTS



Concrete slabs for railway and highway crossings, mile posts, whistle posts, rail rests, fence posts—

Everything in pre-cast concrete products.

THE PRENDERGAST COMPANY

MARION

OHIO

Sole Agents

"One Syntron Power Unit operates all these"



**1500 Blows
a minute!**

Zip-zip-zip-zip! One right after another. Fifteen hundred every minute. Swift, powerful, strokes, packing ballast squarely under the tie. No waste motions, no loss of time, no high labor costs. That's the Syntron Electric Tie Tamper.

*Rail Drill
Bonding Drill
Nut Tightener
Spike Hole Drill
Screw Spike Driver
Rock Drill
Grinders—Portable
Grinders—Bench
Grinders—Floor
Rail Saw
Wood Saw
Riveting Hammer
Chipping and Scaling
Hammer
Water Pump
Flood Lights
Rail Layers
Electric Arc Welder
Rail Bonding Welder
Paint Spraying Outfit
Spike Drivers*

and

Tie Tamperers!

4-tool and 6-tool equipment

SYNTRON COMPANY
Pittsburgh, Penna.

JUST think of all the uses for a Syntron Portable Outfit on your lines. Besides tie tamping, the Syntron Power Unit is designed to drive a score of electrical tools, including those listed above. The Syntron has advantages to be found in no other Outfit. The Power Unit is small, compact and light in weight. It uses very

little fuel, is equipped with Dolly wheels for track transportation, is easily lifted by four or five men, rests on the track shoulder and operates many portable tools.

A complete description of this efficient outfit will be sent to any one on request.

SYNTRON

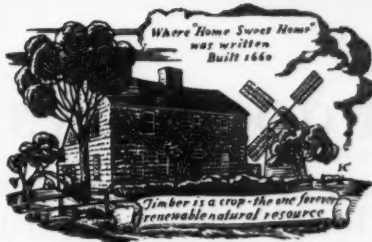
Electric Tie Tamperers



Let the N.L.C. *find "X" in your problem*

"N.L.C." . . . three cryptic letters, stand for the National Lumber Consultant, who is able to discuss the right uses of wood as well as the right wood for every use. He and his associates are fitted to cope with the largest problems confronting the manufacturer either in the maintenance of plant, building or equipment; or the smallest problems incidental to the use of wood as a raw material in the manufacture of his product.

Just as it is possible for "the Jack of all trades to be master of none" so the corps of experts is divided into highly specialized groups, each studying a particular problem. Through the fund of their experience numerous instances are



noted where manufacturers who previously used wood have temporarily turned away to some substitute and then have reverted to the use of wood as the solution of their major problems. Not a single month passes without some dramatic instance being recorded where members of this corps have been able to effect large and appreciable savings to their clients.

A request on your letter-head will bring either additional information regarding this service, or a personal call from the "N.L.C.", as you desire.

Remember this service to you is absolutely without cost, and without thought of obligation!

NATIONAL
LUMBER
MANUFACTURERS ASSOCIATION
WASHINGTON, D. C.

AMERICAN STANDARD LUMBER FROM AMERICA'S BEST MILLS



"Quality leaves
its imprint"



Slidetite, for doorways of any size

INDUSTRIAL doors, necessarily big and heavy, equipped with *Slidetite* Industrial Door Hardware are operated with amazing ease. Smoothly they slide and fold to either side, leaving the doorway unobstructed. Most practical for any opening up to 30 feet wide. They stay where placed, and are so supported they cannot sag. Simplifies all doorway problems, large or small. Saves a world of bother. R-W equipment is used with unfailing success in thousands of big industrial plants.

A Big Thing for Big Doorways

Slidetite Industrial Door Hardware is fulfilling every requirement of big doorways with the same unequalled efficiency that distinguishes every product bearing the R-W Trademark. Garage, barn, house, fire and elevator doors will always work right when equipped the R-W

way. The Richards-Wilcox Engineering Department is constantly rendering service to thousands in simplifying doorway problems. Write them on the installations you wish to make. It costs you nothing. They're glad to help you.

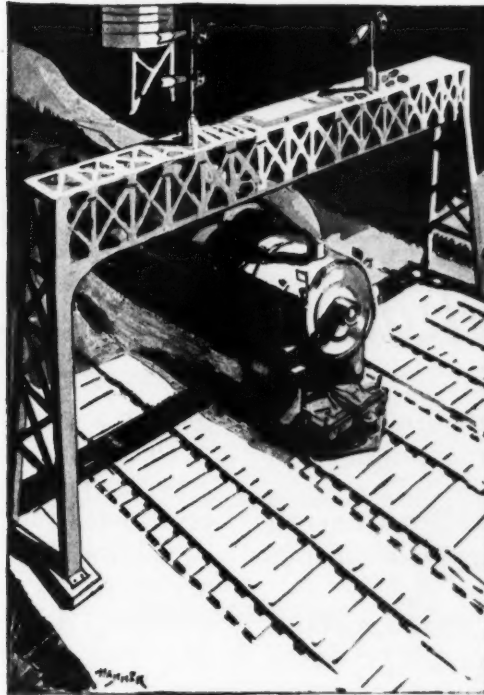
Richards-Wilcox Mfg. Co.

"A Hanger for any Door that Slides."

AURORA, ILLINOIS, U.S.A.

New York Boston Philadelphia Cleveland Cincinnati Indianapolis St. Louis New Orleans
Chicago Minneapolis Kansas City Los Angeles San Francisco Omaha Seattle Detroit
Montreal • RICHARDS-WILCOX CANADIAN CO., LTD., LONDON, ONT. • Winnipeg

HERE IS UNUSUAL Protection for all Exposed Structures



MAINTENANCE Engineers have found that Aluminum Paint is an excellent protective coating for every exposed surface—whether of steel, wood, brick or concrete—because of its unique “leafing” property. The tiny flakes of pure aluminum overlap, forming a continuous “coat-of-metal” which stubbornly resists corrosion or decay, smoke fumes, gases and the elements.

Aluminum Paint is ideal for signal structures and towers, water tanks, bridges and high tension wire carriers, whether of wood or steel. It will protect and at the same time improve the appearance of your right-of-



The pigment base for the best grades of Aluminum Paint is Albron Aluminum Bronze Powder, made of pure Alcoa Aluminum. In order to secure the best results, be sure to specify “Albron” Powder.

It will protect the interior of the round house from fumes and give it better light. Shop interiors, too, are improved by Aluminum Paint.

From every standpoint Aluminum Paint is economical: it costs no more than ordinary paints; it requires less frequent repainting; it spreads farther; its hiding power is great (one coat hides any under color—even black), and on interiors one coat is usually sufficient.

Let us send you full particulars about this modern protective coating.

ALUMINUM COMPANY OF AMERICA

2402 Oliver Building, Pittsburgh, Pa.

Offices in 18 Principal American Cities

ALUMINUM COMPANY OF CANADA, Ltd., Toronto, Montreal, Canada

ALUMINUM IN EVERY COMMERCIAL FORM





Announcing
The Q & C Self Adjusting
Sliding Type Derail

A new era in derailing, reaching new heights in economy and efficiency.

This derail is self adjusting under all conditions to the various heights of rail.

One size will fit all rail sections from 4¾" to 7" rail. The derail blocks and housings are interchangeable.

Base plates are cast integral, extending under the running rail,

giving a firm installation and a perfectly aligned block, assuring a positive derailment. This also eliminates rail braces.

Adzing and shimming the ties are eliminated.

The Q & C Self Adjusting Sliding type Derail is designed for use with standard screw jaw and rod connections in all interlocking and operating stand installations.

Standard track tools are used.

The Q & C Company, 90 West St., New York - Chicago - St. Louis
San Francisco

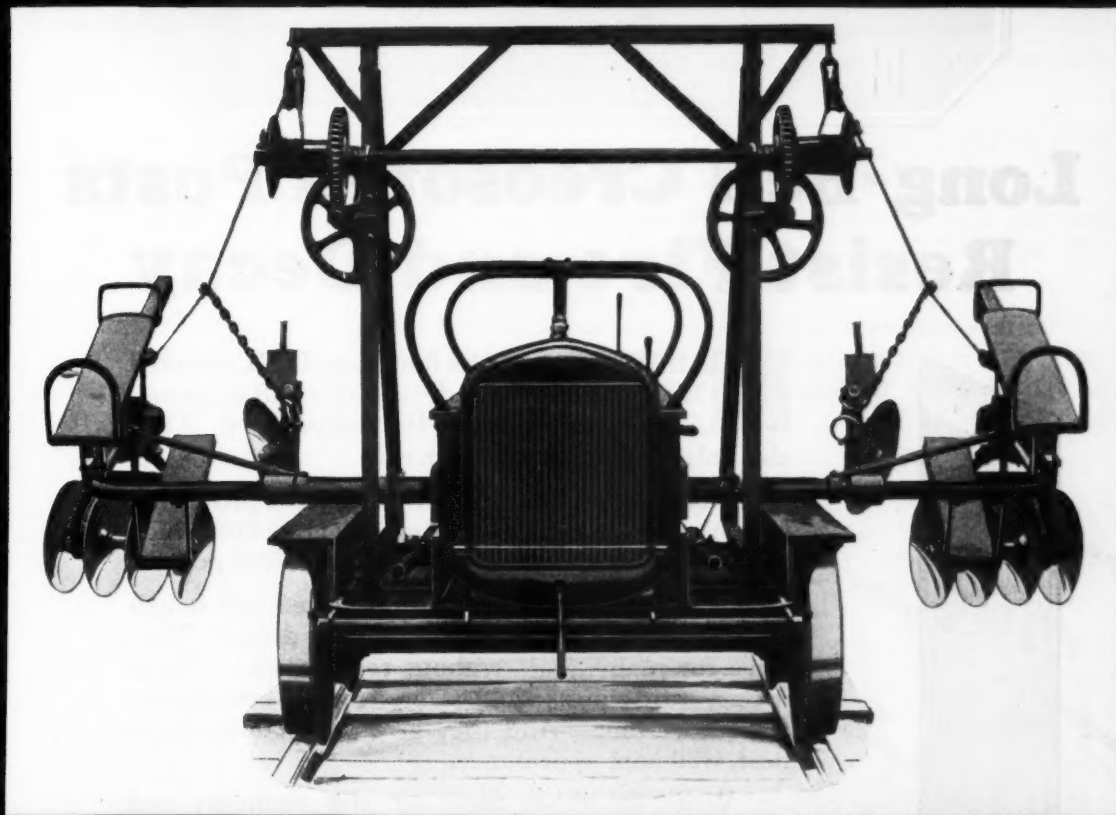
*You are cordially invited to visit
our exhibit during the National
Railway Appliances Convention
at Chicago, March 5th, 6th, 7th
and 8th*

Booths 120-139

CONSTANT PROGRESS MAKES BETTER RAILROADING

New and Improved!
Casey Jones 581
REG. U.S. PAT. OFF.
Ballast Discer

**WITH WORM GEAR ADJUSTMENT of DISC HEADS
 and MECHANICAL ELEVATING DEVICE**

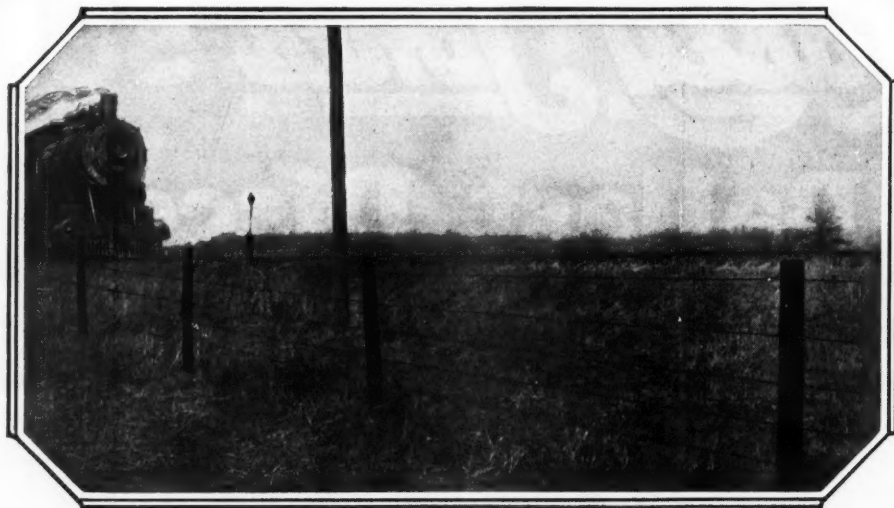


**Weed Destruction—Ballast Agitation and Drainage—Establishes a
 Perfect Grass Line—Shapes Shoulders Giving Desired Contour—
 Improves the General Appearance and Condition of the Right of
 Way—Operates in All Kinds of Ballast—Small Investment and
 Low Cost of Operation Per Mile—An All-Purpose Heavy-Duty
 Railway Motor Car**

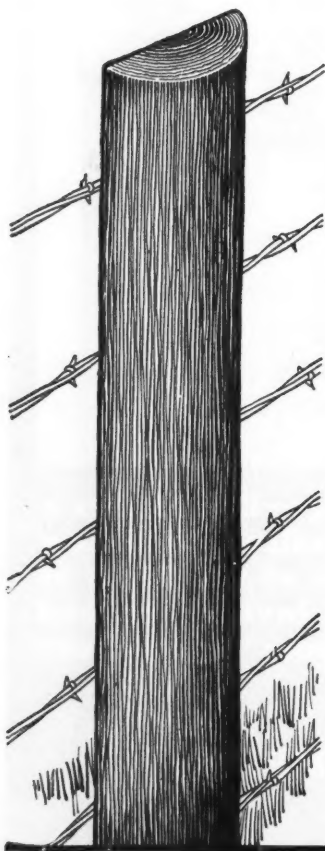
NORTHWESTERN MOTOR COMPANY

EAU CLAIRE, WISCONSIN, U. S. A.

Right-of-Way Protection!



Long-Bell Creosoted Posts Resist Fire and Decay



RAILWAY companies find Long-Bell Creosoted Yellow Pine Posts dependable and economical aids in protecting the right-of-way. They also reduce maintenance expense.

Practical tests over a period of years prove that Long-Bell Creosoted Posts resist brisk grass fires which would weaken or destroy ordinary untreated posts.

Long-Bell Posts are pressure treated full length with creosote, fortifying them against decay. They serve for many years without replacement. These strong, sturdy posts hold staples firmly, keeping the fence wire taut. And they give the right-of-way a neat, well-kept appearance.

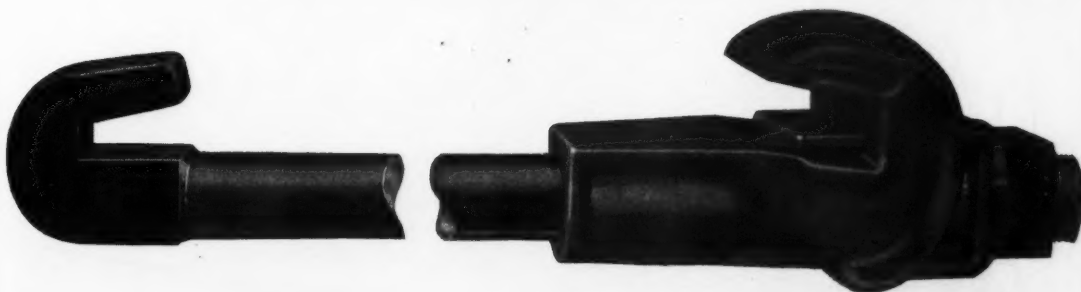
Write for other facts on the economy and efficiency of Long-Bell Creosoted Yellow Pine Posts for right-of-way fencing.

The Long-Bell Lumber Company
R. A. Long Bldg. Kansas City, Mo.

Long-Bell

CREOSOTED Yellow Pine Fence Posts

AND NOW— A UNIVERSAL TIE-ROD



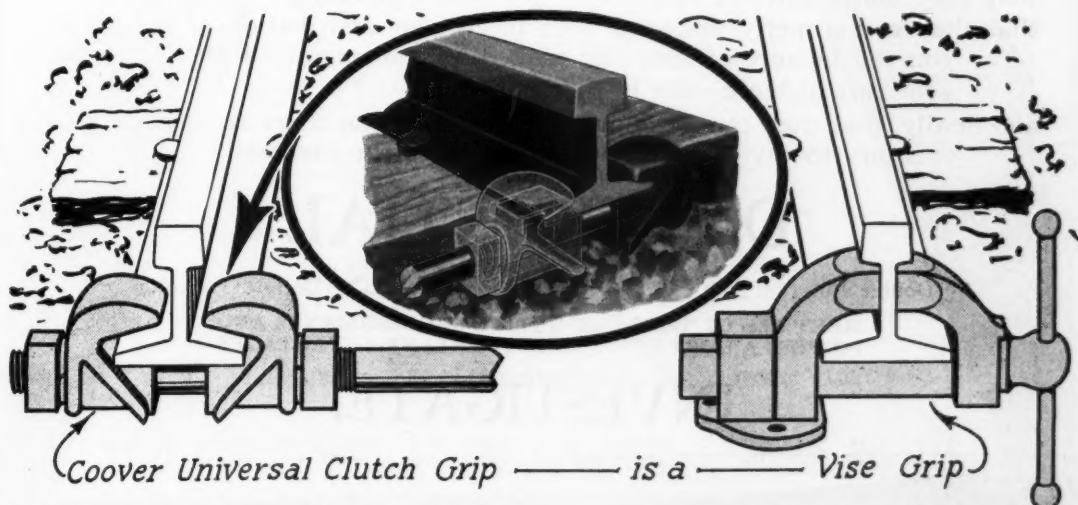
It is a common mistake to compare the Coover Brace with its vise like grip, as shown below, with a cheaper device known as a tie-rod.

That is why we have developed the *new universal tie-rod* shown above. The clutch being adjustable to all rail sections.

Naturally our Coover *Universal* tie-rod, as every other tie-rod, has but one clutch and can be sold much cheaper than the Coover Brace which has *four vise like clutches*.

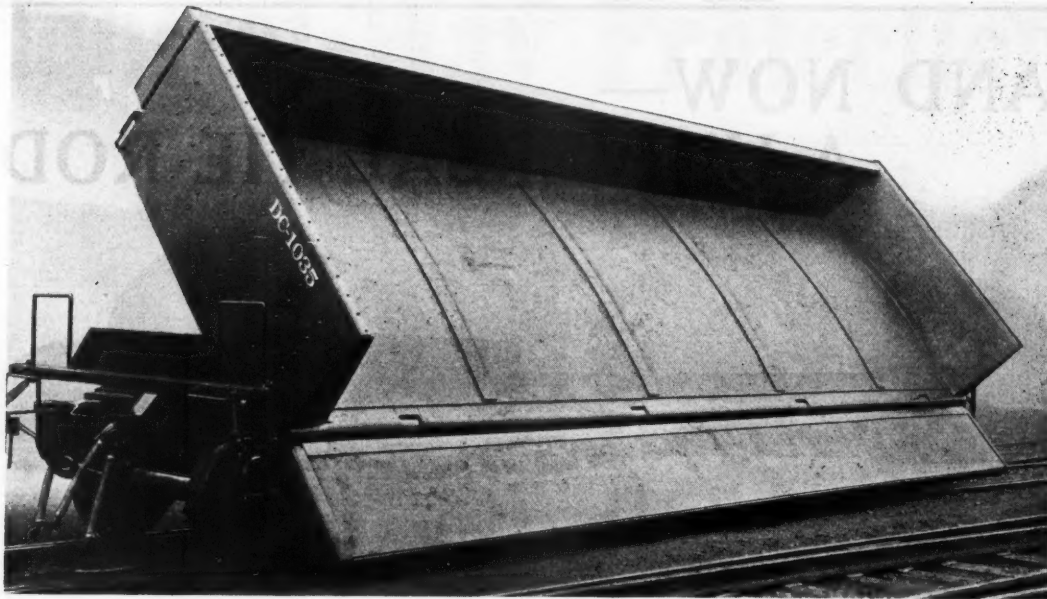
The tie-rod, however, only functions as an anti-rail spreader—while the Coover Brace, with its four vise like clutches, holds rails so firm that they cannot spread, tilt or creep—and your track stays put, regardless of Ballast, Tie, Weather or Operating Conditions.

Compare the results and let us quote you on your requirements.



THE COOVER RAILROAD TRACK BRACE CO.

Dayton, Ohio, U. S. A.



— PATENTED —

IN CHOOSING YOUR DUMP CARS BE SURE

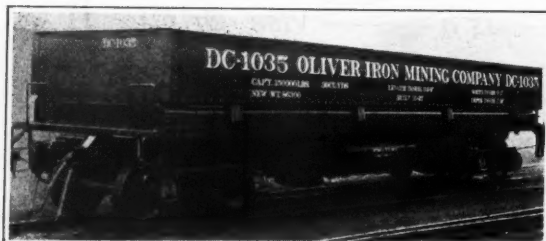
that they dump by air and require no labor,
 that they are low in height and stable in transit,
 that they are absolutely safe and do not have any locking mechanism to
 cause loss of time, repair charges and accidents,
 that they have a down-folding door and the double fulcrum principle of
 support so you can be sure of keeping your ballast clean,
 that they dump quickly, surely, and give clean discharge,
 that they are properly designed with intelligent distribution of weight so
 you can be sure of long life with minimum maintenance. You want
 your cars at work—not in the shop,
 and finally, that they cannot dump accidentally—that there is no possibility
 of injury to any member of the crew or to the car itself.

DIFFERENTIAL

Double Fulcrum **AIR DUMP CARS** Double Trunnion

MEET ALL OF THESE ESSENTIAL REQUIREMENTS AND
 POSSESS A HOST OF OTHER IMPORTANT ADVANTAGES

INVESTIGATE!



THE DIFFERENTIAL STEEL CAR CO.

FINDLAY, OHIO



LOW UPKEEP



NOW you can reduce the cost of maintenance of grade crossings to virtually *nothing*! Impossible you say? Not so long ago it was impossible—but no longer. The Lebanon Steel Flangeway Guard has proven itself the answer to the problem—and assures a smooth, safe crossing for years—with practically *no* expense for upkeep!

The Lebanon Steel Flangeway Guard is so constructed that after installation there is no connection whatever with the running rail. This means that the paving remains undisturbed by undulation and does not become cracked or broken. A distinctive Lebanon feature.

The Lebanon Guard maintains uniform clearance between paving and running rail—allowing ample room for electrical equipment and for work on rail joints, etc. It is easily and quickly installed. Our engineers will be glad to assist you with your crossing problems.

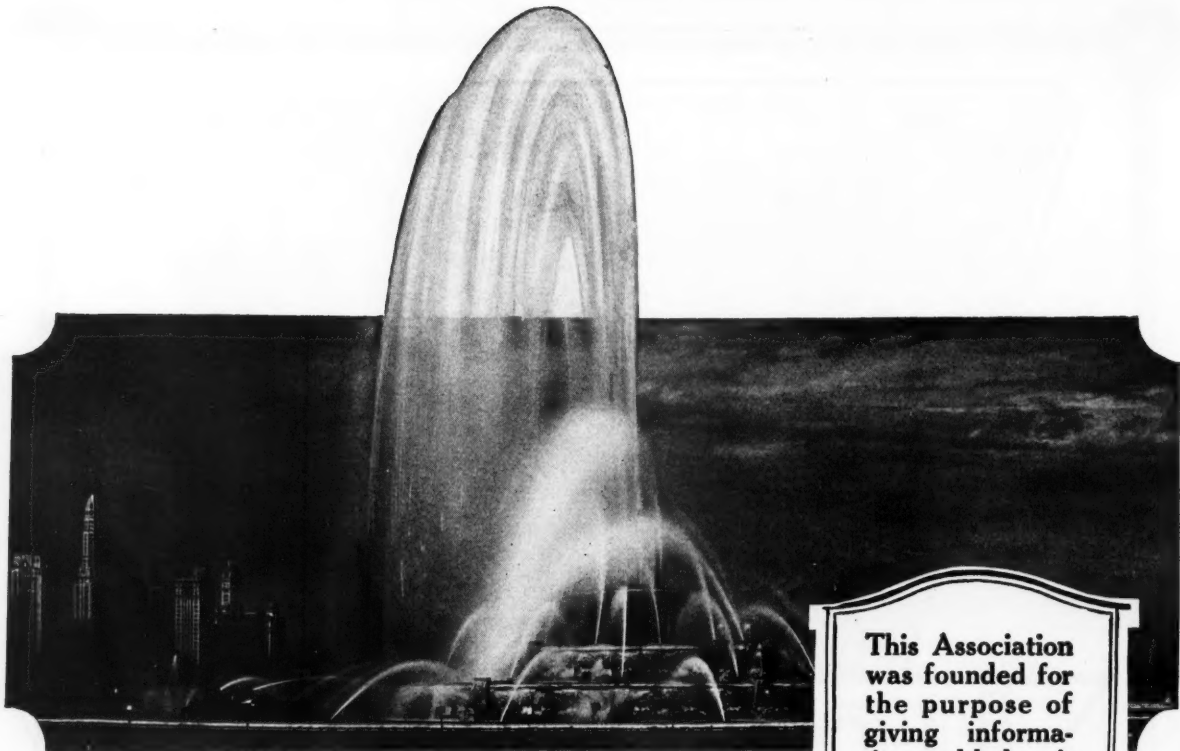


Lebanon Steel Foundry — Lebanon, Pa.

VISIT OUR EXHIBIT AT THE COLISEUM — SPACE NO. 116

LEBANON STEEL FLANGEWAY GUARD

PATENTED



© by Henry Fuermann & Sons, Chicago

Bell and Spigot Cast Iron Pipe is built right into the fountain itself —

The Buckingham Fountain in Grant Park, Chicago, was built as an everlasting memorial. The Cast Iron Pipe once installed had to last indefinitely.

WHEN turned on full the fountain has a pump capacity enough to supply a city of over 150,000 people. The basins hold three and a half million gallons of water. The piping is of Cast Iron with diameters from 4" to 20".

Cast Iron Pipe was selected for its low maintenance cost and permanence.

Over 250 years ago another famous fountain was built with Cast Iron Pipe supply lines, the fountain in the garden of Versailles in France.

Once installed Cast Iron Pipe can be forgotten—a matter of vital interest to every taxpayer, construction engineer and municipal official.

THE CAST IRON PIPE RESEARCH ASSOCIATION
People's Gas Building, Chicago, Ill.

This Association was founded for the purpose of giving information and help—it has nothing to sell.

Its primary interest is the collection and distribution of all information relative to Cast Iron Pipe for all purposes—and in arousing public interest in waterworks construction.

Consulting engineers, contractors and municipal officials are invited to write.

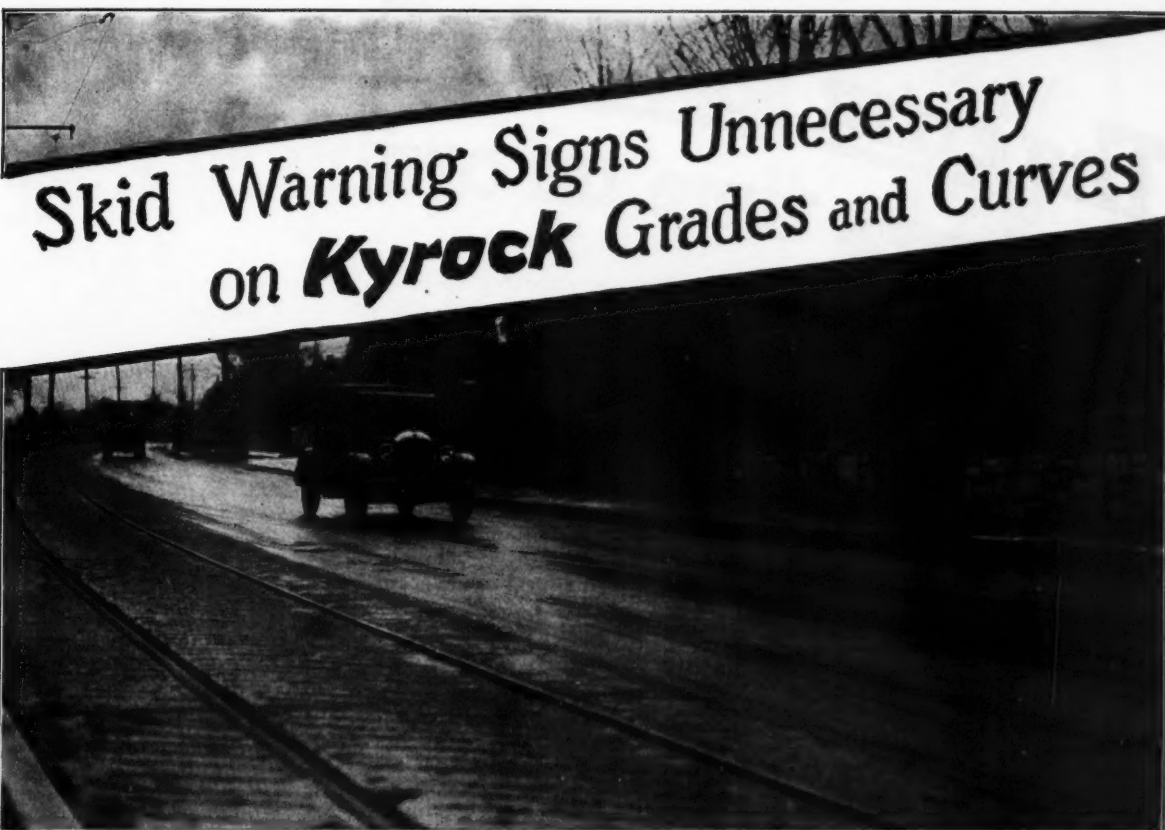
Of especial importance is an article on the "two mains system." Write to the Research Engineer for a copy of this or other literature on the subject of water systems which may be interesting to you.



BELL and SPIGOT JOINT—
the accepted standard for underground construction.

CAST IRON PIPE

—in continuous service for over 250 years



From photograph of Stafford's Taxi as it made an emergency stop from 35 miles per hour on wet "Kyrock." East Main St., Frankfort, Ky., 7.38% grade on 3/8 mile continuous curve. Corrugated concrete in trolley section. The "Kyrock" surface on the street makes this dangerous hill SAFER. "Kyrock" presents an ideal traction surface of fine silica sand. There is no appreciable difference in its traction qualities when wet. Put "Kyrock" on your streets and reduce skid accidents. KENTUCKY ROCK ASPHALT Co., Incorporated, Louisville, Kentucky

AFFIDAVIT

STATE OF KENTUCKY

FRANKLIN COUNTY

} SCT.

I, Forrest Stafford, of Stafford and Penn Taxi Company, of Frankfort, Kentucky, do hereby state that on the 23rd day of November, 1927, I drove a taxi down the hill of East Main Street of Frankfort, Kentucky, at the rate of thirty-five (35) miles per hour, and on applying my brakes, found that the wet asphalt of said hill would not cause the taxi to skid. Said test was made following a heavy rain, and the taxi was brought to a quick stop without noticeable skid.

(Signed) FORREST STAFFORD

Subscribed and sworn to before me by Forrest Stafford, this November 25th, 1927. My commission expires February 12, 1928.

(Signed) MABEL C. TAYLOR

Notary Public, Franklin County, Ky.

Kyrock
The Perfect
Pavement



The extra speed for Emergencies saves time on ordinary work

This railway crane's *extra speed*—vital in an emergency—also saves costly time on ordinary work such as placing machinery, handling heavy freight, etc.

First compare the BUCYRUS-ERIE Railway Crane for speed. Larger hoist drums and faster line speeds are made possible by its extra power. The swing is faster too, partly due to the unique jib construction that gives the needed strength with less weight.

And the easier control permits the operator to concentrate on his work and the signals—for instance the release throttle for lowering heavy loads is a big asset, both for ease of operation and extreme accuracy.

Strength for Fast Heavy Work

At every point BUCYRUS-ERIE Railway Cranes have surplus strength, to stand up under capacity lifting at high speed. The revolving base is a massive one-piece steel casting, practically indestructible; and the entire machine is built to this same standard.

Compare these cranes for Speed; for Strength—for Low Center of Gravity, Freedom from Pitch—for every feature that you need for emergency and general yard work.

You'll find that the preference of leading roads for BUCYRUS-ERIE Cranes is based on *inbuilt merit*.

BUCYRUS-ERIE COMPANY

Erie, Pa.

South Milwaukee, Wis.

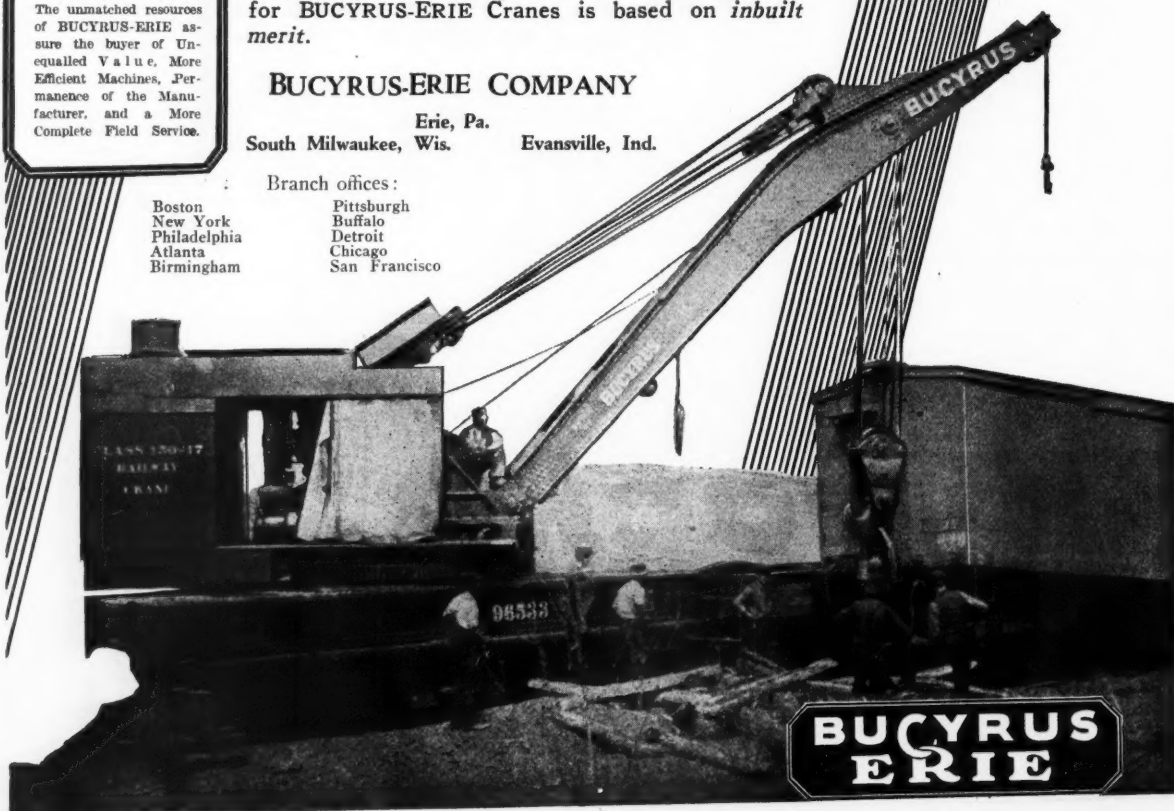
Evansville, Ind.

Branch offices:

Boston
New York
Philadelphia
Atlanta
Birmingham

Pittsburgh
Buffalo
Detroit
Chicago
San Francisco

A Union of Strength
"BUCYRUS" and
"ERIE"—each the most
successful manufacturer
in its particular field—
consolidated Jan. 1, 1928.
The unmatched resources
of BUCYRUS-ERIE as-
sure the buyer of Un-
equalled Value, More
Efficient Machines, Per-
manence of the Manu-
facturer, and a More
Complete Field Service.





Equip your ditchers with *Haywards*

On the heels of winter comes plenty of ditching work. With March and April ahead, it will pay you to equip your ditchers with Hayward Buckets.

Haywards have proved their worth in this work. They are at home in hard-packed soil or in the muck and mire of a wet digging job. Powerful penetration of the material is a Hayward characteristic; rapid opening and closing action is another.

Let a Hayward engineer advise you, and recommend a bucket fitted to the job.

THE HAYWARD COMPANY

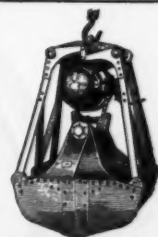
46 Dey St., New York, N. Y.

Builders of Clam Shell,
Orange Peel, Drag Line,
and Electric Motor
Buckets; Dredging Exca-



vating and Coal Handling
Machinery; Automatic
Take-Up Reels, Counter-
weight Drums.

Hayward Buckets



Electric Motor Buckets



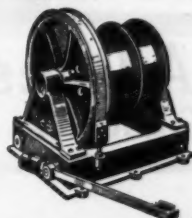
Clam Shell Buckets



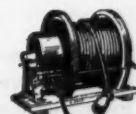
Orange Peel Buckets



Drag Scraper Buckets



Counterweight Drums



Automatic Take-Up Reels



Skid Excavators and
Dredges



A Question You Have a Right to Ask

Can Repairs and Time-Out-of-Service be Reduced by Alloy Steel?

In striving toward lower maintenance costs, is it well to overlook a factor which in dozens of industries has effected substantial economies?

Alloy Steel has remarkable ability to resist wear, impact, stress or strain. Because certain locomotive parts are subject to these things in

a most unusual degree, alloy steel deserves the serious consideration of any official interested in reducing time-out-of-service and maintenance expense.

Our engineers will be glad to discuss this important subject with you.

Illinois Steel Company
Chicago

ILLINOIS Alloy STEEL



*North — South —
East and West*

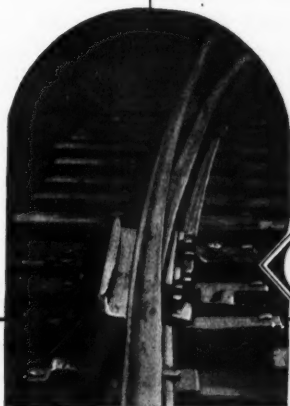
*They come in from all directions
pounding your Switch Points*

Visit the maintenance display of the March Convention, booths 120 and 139.

IN the big yards throughout the country, thousands of switch points are being changed every day, representing a tremendous expenditure, which can be practically eliminated through the use of the *Q & C Switch Point Guard*. This device costs less than the switch point and will prolong its life many times. It is an absolute preventative for derailments and gives added bracing to the stock rail opposite the switch point.

The *Q&C Switch Point Guard* is a simple one piece casting made of manganese steel. It is applied on the outside of the running rail, assuring safety. There is practically no maintenance.

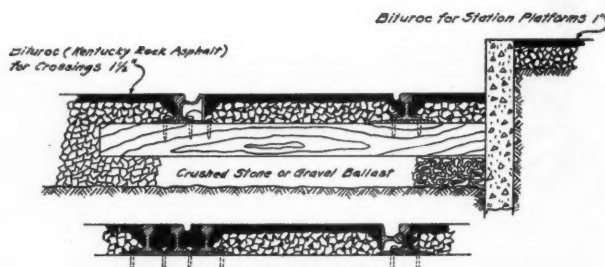
Detailed information and prices gladly furnished.



The Q & C Company, 90 West St., New York
CHICAGO SAN FRANCISCO ST. LOUIS

Q & C Switch Point Guards

Bituroc
KENTUCKY ROCK ASPHALT
TRADE MARK



Typical section of Bituroc crossing
—and station platform—

SURFACING

BITUROC
KENTUCKY ROCK ASPHALT

MAINTENANCE

BITUROC

Shipped in bulk ready to apply by section foremen
Does not deteriorate in stock

OUR FIELD MEN WILL BE GLAD TO ASSIST
YOU WITH ANY INSTALLATIONS OF BITUROC

Ohio Valley Rock Asphalt Co.

STARKS BLDG.

(INCORPORATED)

LOUISVILLE, KY.

Bituroc
KENTUCKY ROCK ASPHALT
TRADE MARK



STRATEGICALLY located to serve manufacturers of cement and plaster are the eight modern factories in which the Bates Valve Bag Corporation make Bates Multi-Wall Paper Bags.

The physical value of these eight plants and their full production schedules reflect the startling increase in the use of paper bags for cement and plaster—an increase of over 223% in the last four years.

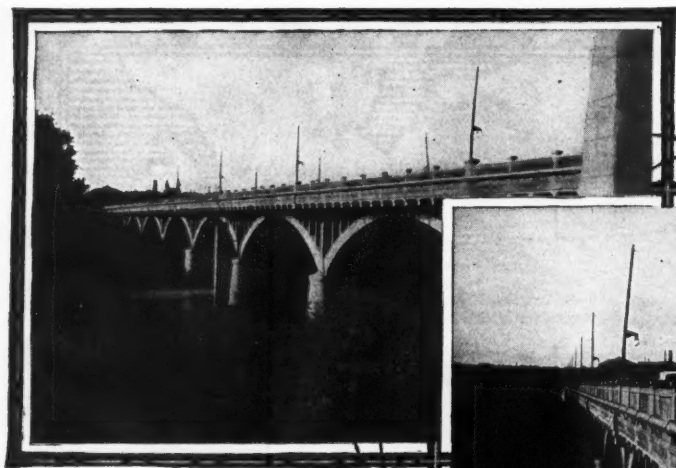
Bates Multi-Wall Paper Bags have had the major share in this development because Bates Bags, better than any other type of container now in use, protect the buyers of cement and plaster against loss.

BATES VALVE BAG CORPORATION
35 E. Wacker Drive • Chicago, Illinois

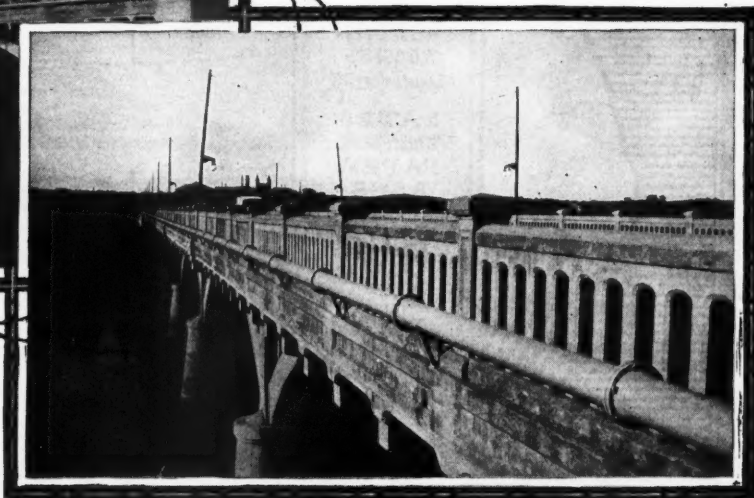
Plants at
CHICAGO, ILL.
MENOMINEE, MICH.
COVINGTON, VA.
NAZARETH, PA.
EAST PEPPEREL, MASS.
BIRMINGHAM, ALA.
LOS ANGELES, CALIF.

CAP DE LA MADELEINE, QUEBEC

BATES *Multi-Wall* **PAPER BAGS**



3" deLavaud cast iron line
at Colorado River Bridge,
Austin, Texas.

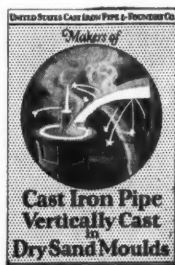


deLavaud Centrifugal Cast Iron Pipe with Anthony Joints makes a *permanently tight line*

SUCH installations as illustrated here are subject to unusual strains and constant vibration. The great tensile strength of deLavaud pipe and the flexibility of the Anthony Joint eliminates the

possibility of these strains causing leakage.

Municipal, industrial or construction engineers should write for literature covering specifications, manufacture and use of deLavaud pipe for high pressure mains.



United States Cast Iron Pipe and Foundry Company

SALES OFFICES

Philadelphia: 1421 Chestnut St.
Chicago: 122 So. Michigan Blvd.
Birmingham: 1st Ave. & 20th St.
Buffalo: 957 East Ferry Street
Cleveland: 1150 East 26th Street

Minneapolis: 6th St.

New York: 71 Broadway
San Francisco: 3rd & Market Sts.
Pittsburgh: 6th & Smithfield Sts.
Dallas: Akard & Commerce Sts.
Kansas City: 13th & Locust Sts.
& Hennepin Ave.

General Offices:

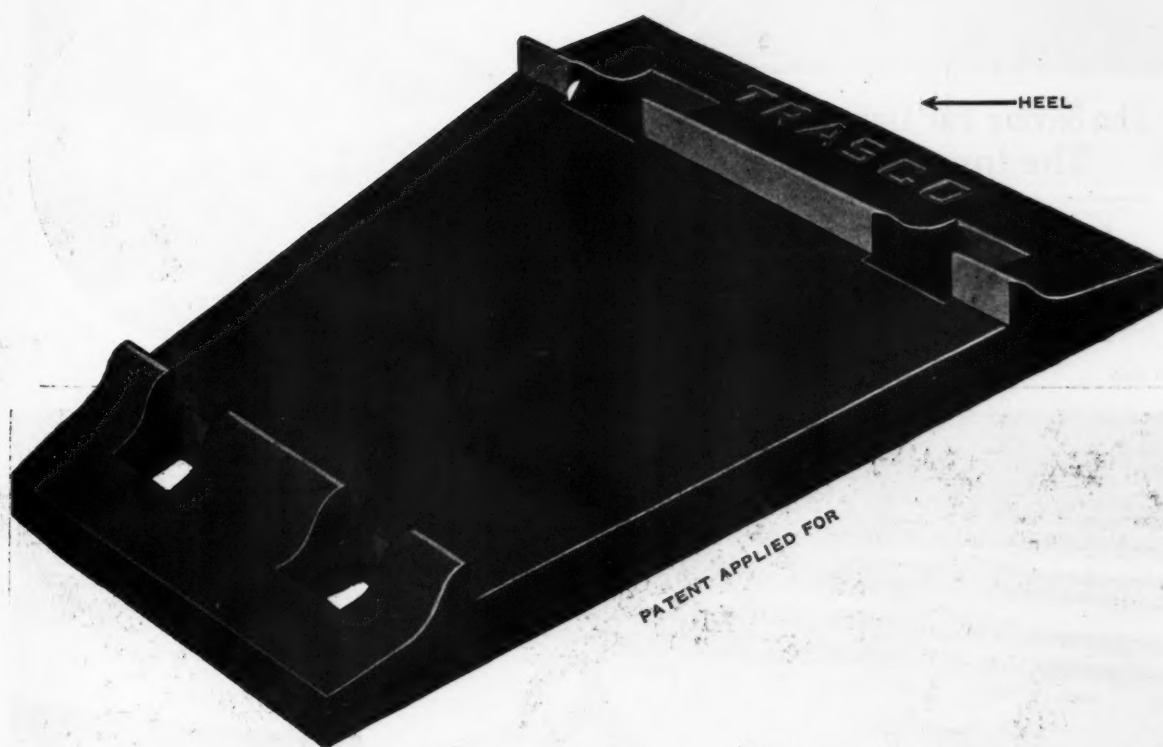
Burlington, New Jersey

TRASCO

TRADE MARK REGISTERED

TRAPEZOIDAL TIE PLATE

"Always On The Level"



This plate doesn't take a heel dive into the tie

Write us for data and prices

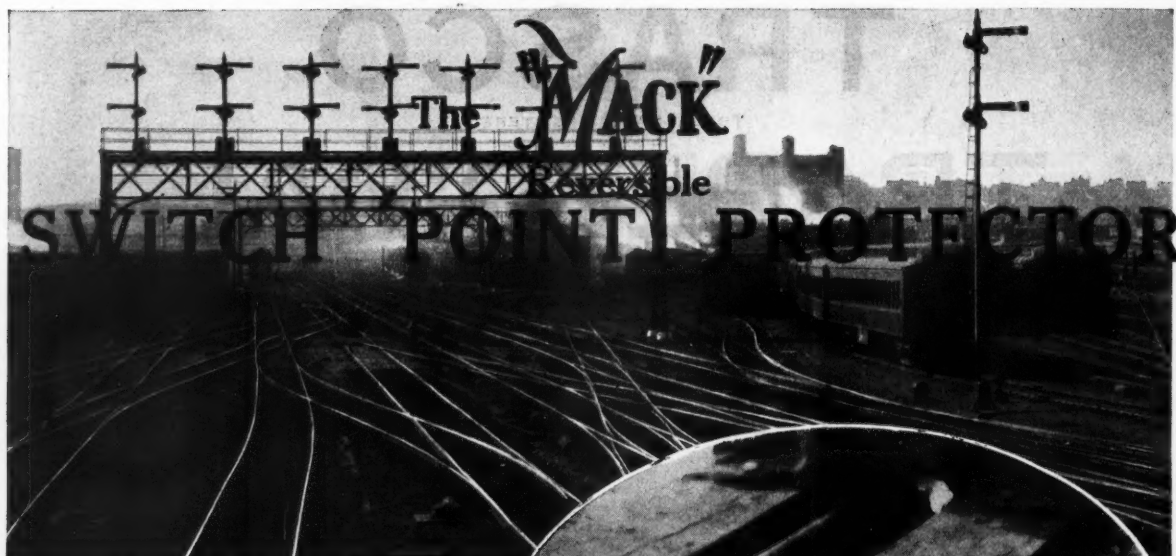


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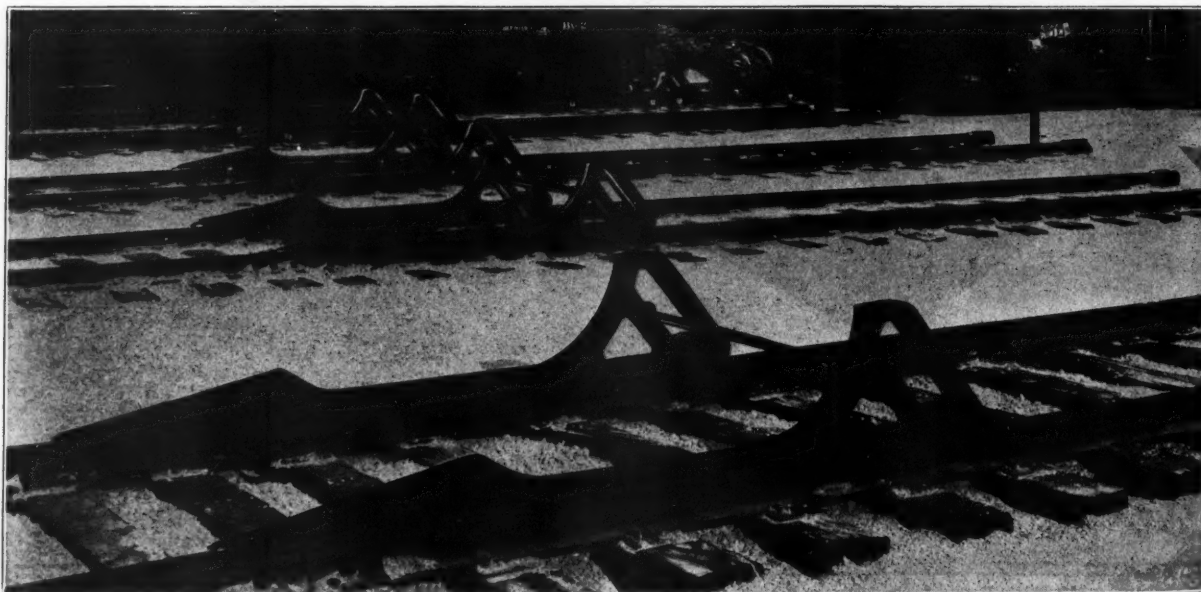
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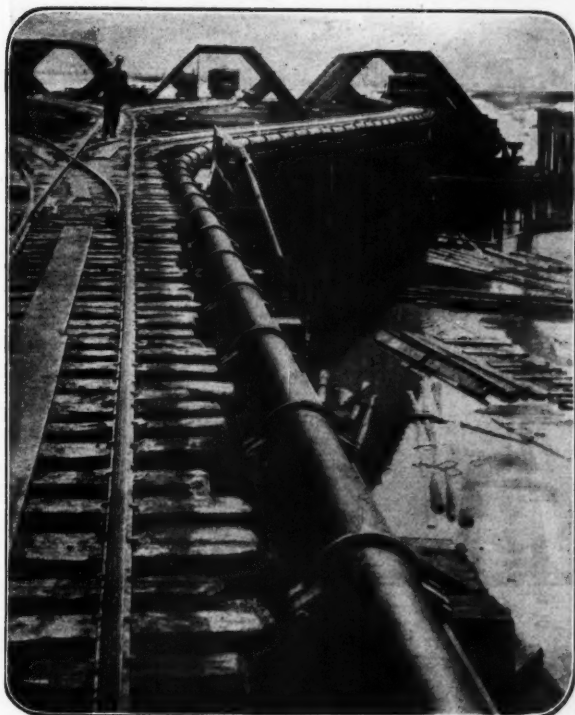
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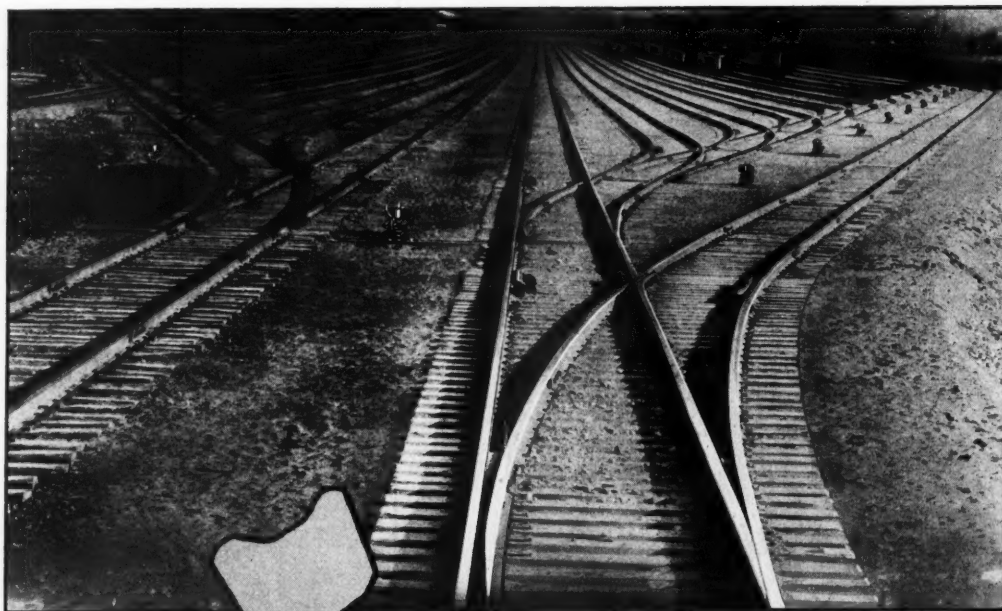
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Railway Engineering and Maintenance

Volume 24

March, 1928

Number 3

The Proof

FEW ROADS have gone further than the Lehigh Valley in the utilization of labor saving equipment in engineering and maintenance of way operations. It has pioneered in the widespread use of locomotive cranes; it was also an early and large user of tie tampers and motor cars and of other equipment of recognized value. This widespread utilization of equipment has been stimulated by carefully guided rivalry between divisions, which has distributed the initiative for its use widely and led to its more universal application.

By reason of this widespread utilization of equipment and the liberality with which it has been provided, it is fair to inquire as to the results that have been secured. These results are set forth in a striking way in the concluding paragraph of the article prepared by G. A. Phillips, engineer maintenance of way of this road, which appears on page 119 of this issue. There it is stated that the pay rolls for maintenance of way labor have shown an actual decline of \$90,000 in 1927 as compared with 1918, notwithstanding the large increases in wage rates that have been made in this period. Even more striking is the reduction of 36 per cent in the amount of labor required last year as compared with 1918. This reduction is not, of course, due solely to the use of labor saving equipment. Much is the result of the use of treated ties, of heavier rail and of other materials which conserve labor. Nevertheless, these figures show the possibilities for the conservation of labor that are open to other roads—possibilities that result from the more scientific direction of forces and utilization of equipment. A record such as this is one that may well be emulated by others.

"Horse Sense"

AMONG the many references to labor-saving equipment on the following pages are two of a cautionary character. One emphasizes the danger of over-equipping a road with a device; the other warns against the man who makes a hobby of a device. The first refers to a danger that is slight as yet, although it may become more real as the use of devices of this character become more universal. The man with a hobby we already have with us, however.

It is said that every man has a hobby—some idea that he will follow farther or devote more time to than he will to other matters of equal importance. If this hobby should be a labor-saving device, care should be taken to see that it is not carried too far. This is no easy thing to do, for many an important development was the outgrowth of the enthusiasm of some individual whose associates regarded it as a

hobby and ridiculed the idea while it was being developed. At the same time the wide-spread use of not a few meritorious devices has been seriously retarded by the excessive zeal of some self-appointed champion who "ran them into the ground." The problem is a very real one for supervisory officers. It is also one for which there is no single answer except "horse sense."

A Labor Saving Issue

FOR THE tenth consecutive year this March issue is designated a Labor Saving Issue and the editorial pages are devoted almost exclusively to discussions of the possibilities for the more general use of mechanical equipment and the problems arising in its use and care, employing the term in its broad sense to include materials as well as devices. We dedicate this issue to the promotion of labor saving equipment because we believe that in the more intelligent and more general use of materials and devices of this character lie the greatest possibilities for the promotion of economy in roadway maintenance as well as the elevation of maintenance labor to a higher plane.

From the beginning of railroads the construction and maintenance of the roadbed, tracks and structures has required a large proportion of the funds and forces. The work has long been done by sheer power of numbers, with the result that between one-fourth and one-fifth of all railway employees have been engaged in overcoming the destruction of traffic and of weather. It is only within the last few years that appreciable progress has been made in the reduction of these forces and a veritable army of men is still required. It is an army indeed, totaling nearly a half million men last summer (487,439 to be exact) and numbering not less than 350,000 men during the winter period of minimum employment.

Indicative of the possibilities for a reduction of these forces is a forecast made by R. H. Ford, assistant chief engineer of the Chicago, Rock Island & Pacific, in an article published in the May, 1922, issue of the Railway Maintenance Engineer, that contemplates the work of 360,000 of these men would ultimately be done in whole or in part by machines. While this would involve a drastic curtailment of forces, the progress that has already been made on some roads shows that it is within the realm of possibility, whenever all of the railways give this subject the attention that a few are now doing. It requires little effort to visualize the economy that would result from a reduction in forces of this magnitude.

A further fact which should not be overlooked is that the use of mechanical equipment results in work being done better and more permanently. It also re-

quires more highly skilled labor, thereby transferring this work gradually from the category of unskilled to that of skilled labor, to its advantage.

It is with a desire to aid in bringing these objectives to pass that this issue is dedicated to the promotion of the more universal and intelligent use of mechanical equipment for the performance of those tasks coming within the scope of maintenance of way forces.

The Ultimate in Track Construction

IN AN article entitled "Have We Reached the Limit?" which appears on page 91, C. A. Morse, chief engineer of the Chicago, Rock Island & Pacific, presents an interesting suggestion regarding the possibilities resulting from the use of heavier rails, treated ties and other track materials of longer life. Briefly, he predicts that the time will come when much of the routine "spot" renewals of ties and other materials will be done away with and in its place will come the complete overhauling of the track in one operation at long intervals, with small forces doing only routine maintenance between times.

There is much to commend this practice, particularly with the more permanent track construction now coming into general use. There should no longer be the necessity for the constant disturbance of the track structure incident to the renewal of individual units, each of which in itself now has a relatively long life. The unit cost of these renewals is admittedly higher than if the work is done out of face, while no small part of the work on the track is now made necessary by its constant disturbance to make other minor repairs.

While reconstruction of the track out of face will require that some materials be taken out before their service life is exhausted, the requirements of the railways are so varied that these materials can always be reinstalled in tracks of lesser importance, a practice which the Delaware, Lackawanna & Western, for example, is already following with reference to treated ties. The suggestion made by Mr. Morse is not entirely new for it is followed on many European roads, where the construction is of a more permanent character than here. Mr. Morse's suggestion points in the direction in which we are moving today. It deserves careful consideration as pointing to a way to conserve labor and promote higher standards of track maintenance.

Some Undeveloped Fields

IN REVIEWING the progress that has been made in the development of labor-saving equipment one is struck with the fact that it is much more pronounced in some directions than in others. In excavating and in earth handling equipment, in motor cars for the transportation of men and materials, in tie tampers and in rail handling machines, for instance, the development is far advanced and these units are accepted as standard maintenance equipment. In other operations, such as the cleaning of ballast, however, less progress has been made and in still others, such as the renewal of ties, little or nothing has been accomplished.

These two operations alone offer as great opportunities as any which have yet been developed. The constantly increasing traffic is making stone ballast a necessity on the busier lines while the large proportion of coal traffic and the growing use of stoker-fired locomotives make the retention of adequate drainage in this ballast a problem of increasing seri-

ousness. Much work is now being done in the development of equipment to meet this need and adequate relief will undoubtedly be afforded in the near future.

The outlook is not yet as promising for aids in the renewing of ties. This task, which involves the replacement of nearly 100 million ties annually, makes greater inroads on the time of track forces than any other single task, with the possible exception of surfacing. Yet, it is still being done in the same primitive way that has prevailed since the beginning of the railroads. As long as such a condition remains, and it is not confined solely to the operation of renewing ties, it cannot be said that there is no longer any opportunity for inventive genius in maintenance of way operations. In at least some respects, the development of equipment to meet the needs of this branch of service is still in its infancy.

The Attitude of the Men

THE instinctive reaction of any workman to the introduction of equipment designed to replace some of his fellows is one of hostility and of self-defense. This has been true of outstanding developments in all industries. It was evident to some degree in the early days of the introduction of labor-saving equipment in railway work. It has never been pronounced here, however, because the men have realized that its result has been primarily to aid rather than to supersede the men already employed.

This has been due primarily to the steadily increasing demands made on the tracks and structures by the growing traffic and by the more exacting standards of maintenance required, which the introduction of labor-saving equipment has been able to offset only in part, as yet. The result of the introduction of this equipment has been, therefore, to enable the forces already employed to do more work and to do it more easily. Its influence is also being felt in the requirement of more skilled forces, the ultimate result of which will be the elevation of all or a large part of the maintenance of way forces to the plane of skilled mechanics. This trend is emphasized by C. A. Morse in the article entitled "Have We Reached the Limit?" on page 91, wherein he points to the necessity of the foreman of tomorrow being more highly skilled than his predecessor in the use of machinery, if he is to use advantageously the equipment that is provided for him. The foreman of today has every reason to interest himself in and promote the use of mechanical equipment to the utmost because it will remove much of the drudgery from his work and make it more attractive and also pave the way for his ultimate advancement to a more productive and therefore better paid level.

The Manufacturer and Service Tests

IT REQUIRES only a hurried glance through the department in this issue entitled "Getting the Manufacturers' Help" to gain an idea of the magnitude of the contribution which the railway supply manufacturers are making to the efficiency of maintenance of way equipment through the devices which they have developed for use in this branch of operation. In no previous year in history has the development been more rapid or more productive to the roads. Likewise, in no previous year have the railways been more receptive to such equipment. As a

result, the progress made was greater than ever before.

In view of this contribution it may not be amiss to call attention to the advantage that accrues to the roads through co-operation with the railway supply manufacturers in the development of new devices. The relation between the two is naturally that of buyer and seller. Yet the buyer does not and should not purchase unless he will profit thereby and if a device has merit, it is to his interest as well as to that of the manufacturer that it be perfected and made available for use as quickly as practical.

It is the belief of some railway men that a manufacturer should perfect his device before bringing it to their attention and that they should not be called on to try it out before that time or to lend their services in removing any "bugs." This position, however, places a handicap on the promotion of a device which it is hard to overcome. Most new equipment requires trial under actual service conditions before defects can be discovered and corrected. Without such service tests, the perfection of a device is delayed. Service tests are of necessity available only in the tracks or structures of a railway and a manufacturer is, therefore, dependent on the roads for this co-operation. In general, maintenance officers are showing a willingness to co-operate that is commendable. If this attitude were universal, however, progress would be still more rapid.

The Necessary Follow Up

IT IS ONE thing to estimate the reduction in cost that a certain device *should* effect in the cost of performing a specific task. It is another and quite a different thing to realize this economy in actual service. One reason for this discrepancy is the common lack of an adequate "follow up" after a device is installed, with the result that it is not applied most efficiently and, more commonly, is not kept busy. After a device is purchased certain elements of cost, such as the interest on the investment, are continuous, regardless of whether the device is active or idle. Economies, on the other hand, are realized only when the equipment is at work. It is self-evident, therefore, that the maximum economy will be secured only when the equipment is working the largest practicable part of the time. Not infrequently, as pointed out by C. C. Cook in an article entitled "Getting the Most Out of Work Equipment" on page 94, the difference between the success and the failure of a device depends solely on the extent to which it is used, a condition within the control of the maintenance officers.

It is estimated that the total investment that the railways have already made in labor saving equipment exceeds \$400,000,000. The interest alone on the investment in this equipment approximates \$9,000 per working hour. On numerous individual roads the investment exceeds \$3,000,000, which involves an hourly interest charge against the maintenance of way department of that road of \$60, equivalent to the wages of a gang of 150 men. If other equally constant charges are included, these figures can easily be doubled. Since these figures continue hour after hour, the problem of the railways is to offset them with operating economies for as large a part of the time as possible.

It requires only a superficial examination of the equipment on the average railroad to demonstrate that the importance of the continuity of operation is not sufficiently appreciated by the local supervisory officers in direct charge of it. In fact, the average maintenance

officer gives little or no thought to these continuing charges. Yet it is this idle time which frequently changes an estimated saving into an actual loss and converts a potential asset into a real liability. It is highly important that a maintenance officer estimate what economies he may expect from a unit of equipment prior to its purchase; it is still more important that he follow up its purchase with sufficient supervision to insure that his estimates are confirmed.

Should the Foreman Be a Mechanic?

TO WHAT extent should a foreman be expected to keep his motor car, tie tamper or other equipment assigned to him in repair? This is a question about which there is a wide difference of opinion. On the one hand are those who believe that a foreman should be held responsible for practically all routine adjustments and minor repairs. On the other hand are those who believe that a foreman's activities should be confined strictly to "first aid" measures, and that other repairs and adjustments should be left to more skilled mechanics.

Much can be said in favor of each contention. There is a danger, however, that we may expect too much from a foreman. It is, of course, true that with the increasing use of machinery a maintenance foreman must become more and more familiar with gas engines and other appliances placed in his charge and that the man who has a natural aptitude for such work will have an advantage over one who is not so inclined. However, a maintenance foreman must have a knowledge also of numerous other matters, not the least of which is that of the methods of doing the work in hand, so that he cannot be expected to specialize too largely in mechanical problems. Furthermore, there is a real danger that a man so inclined and so instructed will tend to "tinker" with the equipment to the detriment of his work. All of these conditions point to the advisability of confining the activities of the foreman to those repairs necessary to the continuance of the equipment in operation until relief can be secured in the regular manner. The situation is not unlike the relation of the average automobile driver to the service station.

The Repair of Work Equipment

AS THE railways increase their investment in labor saving equipment, it is necessary that they also give more attention to its maintenance. Up to the present time this problem of equipment maintenance has received relatively little attention and, in general, the facilities for the care of work equipment are of a makeshift character. This policy might have been excusable when the investment was small and the needs undetermined, but it is no longer so.

When work equipment was first introduced and the number of units was relatively small it was natural that the repair of these devices should be turned over to the mechanical department. At first glance, this might appear logical as a permanent practice for it utilizes existing shop facilities. However, these shops are equipped for work on cars and locomotives, rather than on such equipment as gas engines, tie tampers, etc., and they are outfitted with tools of a widely different character than those required for roadway machines. Furthermore, the type of experience required of the mechanics is different. Even more serious, however, is the division of responsibility which this plan involves between the forces responsible for the maintenance of

the equipment and those responsible for its use. Such a division cannot result otherwise than in a loss in efficiency, regardless of the degree of co-operation intended.

Scarcely less deficient is the practice found on not a few roads where the maintenance of way department sets up a so-called repair shop in a couple of box car bodies or a corner of an abandoned building, equips it with a few tools discarded by another department and mans it with a few "handy men." While division of control is eliminated in this way, the impossibility of providing adequate maintenance with facilities of this character is evident. This expedient is therefore little better than the first.

Rather than satisfying itself with either of these expedients, a road should recognize that adequate maintenance of equipment is as important as the intelligent selection of the equipment itself and should include provision for maintenance at the time the purchase is authorized. With an investment in maintenance equipment on many roads exceeding a million dollars and increasing steadily, the importance of keeping this investment at work is great enough to warrant the outfitting of a shop with tools selected especially for the tasks to be done and the organization of a force of workmen of the proper experience in order that this equipment may be maintained in serviceable condition and at minimum cost.

The Retirement of Equipment

AS THE railways adopt labor-saving equipment more extensively, one of the problems that will confront them is the determination of the time when this equipment should be retired and replaced with that of more modern and more efficient design. This problem is not solely one of the future but is already here with some types of equipment such as grading machinery and motor cars. It is commonly recognized that when equipment becomes so worn that repairs become excessive and breakdowns frequent, it is time to replace it and this is generally done, although it is not difficult to find exceptions to this practice. It is not as generally recognized, however, that equipment may become uneconomical to operate long before it is worn out. The purchase of any device is warranted only when its operation results in a saving more than sufficient to pay the interest on the investment. Once such a device is bought, it may be expected to effect this saving indefinitely throughout its life. Yet, this may not be sufficient.

The development of machinery is proceeding with startling rapidity in all industries today. Its pace is particularly rapid in the field of maintenance and construction operations. The result is that a machine that is efficient today may be so over-shadowed by newer and more efficient equipment tomorrow as to make the older unit uneconomical, at least in comparison with the new. The more progressive and successful industries, of which the electrical industry is an outstanding example, have been alert to utilize every new development, even though it involves the replacement of relatively new but less efficient units. This is a lesson that railway maintenance officers still have to learn.

It is not enough that a device shall continue to earn a good return on the investment. The real test is whether it will earn as great a return as a later and more modern development. If not, a road is losing money by continuing it in service in lieu of the more economical unit.

What Our Readers Think

Are the Ballast Cribs too Full?

Chicago, Ill.

To the Editor:

For the past several years there has been a considerable tendency for track men to lower the height of the ballast in relation to the rails and ties, especially on stone ballasted roads. About 10 or 12 years ago we started stone ballast work on the Canadian Pacific in Quebec and while we did not fill the cribs at the time, the track settled enough to allow the stone to show well above the ties a very short time later.

During a fall inspection of the New York Central Lines, a party of their supervisors visited Montreal and one of these men, who is still a supervisor on the N. Y. C., commented to the effect that our track was far too full to be handled economically by track men. He informed me that his ballast was dressed about two inches below the tops of the ties and I found this to be the case in most places on this railroad throughout New York state. Almost immediately after this, we trimmed our ballast below the tops of the ties and the standard on the C. P. R. now is one inch below the top of tie at the center and two inches at the ends of the ties. It was noticed almost immediately that section men could do much faster work in spotting up such track, and that tie renewals could be made for little more than half the cost incurred where the cribs were full.

Naturally, shimming in the winter time is handled much more successfully where the ballast is kept away from the top of the ties. The Canadian Pacific trims the ballast by using the new ties as gages rather than the old ties which are apt to be rail cut to a considerable extent. Where this is done, it often will be observed that the ties appear to stand out of the ballast from two to three inches. The Canadian Pacific ties are seven inches in depth and it was found that the stone ballast held the track in good line at all times.

Carrying this thought further, it will be found that almost any ordinary gravel ballast track can be made practically as clean as rock ballasted track where the ballast is dressed slightly below the tops of the ties. The gravel ballast or cinders should not be dressed as low as stone ballast but if the tops of the new ties are used as gages, it will be found that plenty of old ties protrude from the ballast to break up the sweep and make a clean track. My observation, after having been out of the United States for some 11 years, is that there is practically no uniformity in the trimming of ballast on the roads in the "States" and that much of the track is too full of ballast for economical maintenance.

E. KEOUGH,
Railway Appliances Division,
American Fork & Hoe Company.

CROSSING ELIMINATION ASSESSMENT.—A bill to change the basis of assessment for highway crossing elimination has been introduced in the New York legislature. By its provisions the assessment on the railways, 50 per cent, is unchanged, but the state is to pay 40 per cent and the city or town is to pay 10 per cent of the cost, instead of an equal division as at present.



Have We Reached the Limit?

A Review
of the Past Forms
the Basis for a Glance
into the Future. New Materials
Require Revision of Methods

By C. A. MORSE

Chief Engineer, Chicago, Rock Island & Pacific

We Have Come Far But Still Have a Long Way to Go

IN considering labor-saving practices and equipment one should go back far enough to include the use of treated track and switch ties and treated timber in bridge construction, as the use of treated timber is one of the greatest labor-saving practices that has ever been developed on our railroads. The fact that we have been able to reduce our tie renewals from as high as 300 to about 150 ties per mile of track per year has meant a great saving, not only in material but in the labor necessary to insert it. The use of treated piling and timber in bridges and the complete renewal of pile bridges with treated material have likewise extended the life of pile bridges to at least double their former life.

The adoption of treated ties brought about the necessity for the use of tie tongs for handling them, and the use of tie plates to reduce mechanical wear. The use of the tie plate developed the advantage of adzing and boring the ties prior to treatment and has done away with the old practice of adzing the ties to make a seat for the rail. The use of the tie plate, together with heavier power, has made necessary the anti-creeper, which has to a great extent done away with the creeping of ties, which required much labor on the part of the section men in squaring them up and returning them to right angles to the track.

Heavy Power Requires Stronger Track

With the introduction of heavier power came the necessity for ballast on practically all lines. The use of ballast has developed the ballast car, pneumatic and electric tie tampers and machinery for cleaning and replacing ballast.

The use of heavier power has also necessitated the widening of many embankments and of the roadbed

through cuts. This has been followed by the development of the ditching machine for use in ditching cuts and widening embankments and in connection with the ditching, the widening of the cuts to provide a wider roadbed through the cuts.

The widening of the cuts and the maintenance of a uniform roadbed and ditch have led to the ditcher-spreader, which provides a uniform width of roadbed through the cuts and a clean and uniform ditch. In its later development it enables this material to be carried forward and spread on the embankment adjoining the cut.

The wider embankments have made desirable and necessary some method of keeping down vegetation. The result has been the development of the track mower which is attached to a motor car and permits the vegetation to be cut over the full width of the top of the roadbed.

One of the sources of great expense is the keeping down of vegetation in the ballast. This has led to the development of the chemical weed killer and the weed burner, and on unimportant lines where gravel ballast is used it has brought forth the discing machine for keeping down the vegetation on the shoulder of the ballast.

On roads that handle many cars of packing house products the brine drippings have caused rail joints, bolts, spikes and tie plates to rust and deteriorate very rapidly. This has led to the development of the track oiling machine for oiling the rail from the head down, thus protecting it and its fastenings. It has been the practice for many years to oil joints and bolts by hand, but by the use of an oil spraying machine they are now oiled with the rail, thus saving much hand labor. The use of the oil spraying ma-

chine also protects the steel work on open deck bridges which also suffers from brine drippings.

Another source of great expense in track maintenance has always been the keeping of bolts tight at joints and the maintenance of the track joints. The development of the heat treated track bolt and the heat treated track joint together with the spring washer, has reduced this expense fully 50 per cent.

The advent of heavier rail and stronger track joints has led many roads to space their ties uniformly, regardless of the joints. The anti-creeper helps to hold the rail without slot spiking the joint, which practice had a tendency to cause the joint ties to creep on the joint side.

Other Devices for Saving Labor

With the practically universal necessity for ballasted track at the present time, the maintenance of good line and surface has resulted in the development of the track liner. This is a comparatively cheap tool by which three men with three of these tools can line and surface track as well or better than it could be done with five or six men that were required when the lining bar was the only tool used in lining track.

With the necessity for better surface on track, the necessity for improving the riding where battered rail ends have developed has led to the development of the oxy-acetylene and electric processes of building up battered rail ends. This practice is common at the present time on portions of the railroad where the weight of rail in track is as heavy as the traffic requires. This problem is also solved on some roads by the use of a portable rail saw, which removes the battered ends in track, after which the rail is driven up and additional rails laid to make up for the portions sawed off. Rail sawing plants, both stationary and portable, have been in use for many years for sawing off battered and dipped ends of rails released with the relaying of rail, and the practice has proved to be very economical for it permits much rail to be relaid in main tracks that otherwise would only be fit for yards and sidings, or for unimportant branch lines.

The development of the motor-driven section car has done away with the hard labor of pumping a hand car to and from work. This has resulted in speeding up the task of going to and from work and saving a lot of energy which can be expended on the work itself.

There are numerous additional devices which have not yet come into general use, but which probably will be common within the next few years. Among these are the power wrench for tightening bolts and the power hammer for driving spikes. Among the heavier mechanical devices, there has been great development in the pile driver, steam hammer, derrick cars for handling bridge and other heavy material along the road, track laying machinery, rail loaders and the magnet in connection with power derricks.

Men of Mechanical Ability Required

The introduction of the various mechanical appliances mentioned above has brought about a condition which makes it necessary, in connection with track maintenance, for track foremen to be mechanics, or of a mechanical turn of mind, and for the men regularly employed on sections to be what are ordinarily termed "handy men" rather than ordinary laborers, this in order that they may use intelligently the mechanical appliances which have been and are being

developed and also that they may be able to keep them adjusted and repaired in order to get the full benefit of the investment in them.

In practice we find that many of our old time section foremen have no mechanical ability and that many of them are unable to become sufficiently familiar with the mechanism of their motor cars to take care of ordinary repairs. The result must necessarily be that in the promotion of men to the position of foreman of a track gang, those must be chosen who have a mechanical turn of mind. This is naturally a slow process as nobody wants to replace an old time first-class man simply because he is not mechanically capable; but it can be done by giving attention to the mechanical qualifications of the men who are being retained as regular employees and who will be promoted to gang foremen.

With the introduction of the many track appliances we are confronted with a trait of human nature which retards our getting the full benefit of these appliances. That is the unconscious resistance of the men to any change in their methods of work. It is no uncommon thing to find a section foreman, who has been furnished some mechanical appliance, going ahead and handling his work in the old manner, leaving the appliance in the tool house. It requires continuous, careful supervision with the introduction of each mechanical tool, to see that the foremen learn to use them properly and continue to use them until they have become convinced of the advantages of their use.

Another trait of human nature sometimes develops in the supervisory forces with the introduction of mechanical appliances, viz, when the roadmaster, division engineer or even the district engineer makes a fad of some one of these methods or devices, with the result that he wants to spend all his money doing a class of work that he can do with the particular appliance that has struck his fancy. There are also many supervisory officers who resist the introduction of many of these appliances on their territories and continue to condemn them even after they have come into common use and their value becomes fully recognized on other parts of the railroad, and on other railroads in the vicinity.

Therefore, it becomes necessary in these times of rapid development of labor-saving devices to follow this subject closely to see that every one from the head of the supervisory forces down to the track laborer is using the appliances that are furnished him and following the methods that have become recognized as money savers, and that he is not allowing his prejudice or his love of a fad to work against the railway getting the full benefit of all of these improvements.

What of the Future?

As for the future improvements in methods and appliances in the maintenance of the railways, the general use of creosoted ties, ballast and heavier rail, together with the development of tie plates and rail anchors, which has taken place within the last few years, is bound to bring about changes in the method of inserting ties similar to those that were developed by the use of creosoted material in wooden bridges. In the old days of untreated material in bridges the bridges were renewed piece-meal with a few piles driven, a new cap or two put on, a few ties inserted and a few pieces of guard rail placed in position each year. This resulted in the division bridge gang having work to do at practically every

bridge every year. With the development of creosoted material it became apparent at once that a great improvement could be made by renewing the bridges complete, and it was then found that all of the second-hand material released from these bridges could be used to advantage and as a rule eliminate the necessity of buying new material for temporary and repair work. The result has been a great saving in the maintenance of pile trestle bridges.

The development of creosoted ties has, on some roads, already brought about the practice of replacing a complete set of switch ties when a certain percentage of the ties require renewal. The ties released by this complete renewal are then used to repair sets of switch ties on secondary lines and in yards so that no loss of life of any of the material in the old set of switch ties occurs. There have been a few experimental installations of track ties in the same manner, and with the increased use of creosoted track ties we are going to see the track ties renewed to a face on our important multiple main lines in the near future, and the released ties used on branch lines and in yards.

Track Will Be Rebuilt Out of Face

In my opinion the practice will be developed of renewing ties at the same time that the rail is renewed. With new ties, new rail and track fastenings and a supply of new ballast for surfacing, an important main line track will then require only a small section gang to maintain line and surface and for the general policing of the track and right-of-way. It is my thought that this renewal of ties in important main lines will be handled by extra gangs and that no tie renewals, except in the case of ties broken by derailments, will be inserted by the section gang on this class of line.

With a tie plate of the proper size the plate will not become embedded in the tie to any appreciable amount and this method of handling will do away with the adzing of ties in connection with the relaying of rail. We will then be able to maintain a much better track and at the same time get the full life out of every tie that is put in the track. The spike killing of ties on curves is, in my opinion, going to be done away with by the use of flange oilers. This appliance will decrease the wear of the outer rail to a point where it will give nearly the same amount of service as on tangent track.

Another development of the near future, following the advent of heavier rail sections, is going to be the revival of the practice that was started nearly 30 years ago of rerolling rail but which has been practically abandoned, due to the increased weight of power requiring a heavier rail. A railway buys a certain amount of material in a rail and when this rail is worn to a point where it is no longer fit for important main line service there still remains sufficient material to make a first-class rail for secondary or branch lines by rerolling. It is going to be found that the economical way to handle rail is to reroll it when it has come out of important main lines.

With the rerolling of rail there will also follow what has been done in a small way for the last two or three years, the reforming of angle bars. It is my prediction that new rail, new ties and tie plates will be laid on important main lines and that rerolled rail, reformed angle bars and second-hand tie plates will be used on secondary lines.

In this connection I call attention to a recommendation made by Frank H. Alfred, president of the

Pere Marquette, two or three years ago, to the effect that the American Railway Association should organize and operate a research laboratory in order to try out scientifically and thoroughly various suggestions that tend toward economy in railway maintenance and present recommendations as to methods to be used. A majority of the large railroads maintain engineers of tests who handle the testing of materials, but there is no railway that I know of that has organized a department to test out methods of handling maintenance work.

Every large manufacturing business in the country has found the research laboratory absolutely necessary but the railroads, the largest industry of all, have apparently failed to grasp the fact that they have a field for research even more extensive than the manufacturers.

Many things are done by the railways in a haphazard manner and they have fallen into many practices through the weakness of many engineers to be termed designers. The result is that we have a multitude of types of tie plates; we have an endless variety in spacings of drillings for joints with no sound reason for this variation. It has simply grown up, as stated above, through the weakness of engineers to turn out something which they are pleased to term *their* design. Incidentally, the engineering societies are still asking whether the applicants for membership are "*capable of designing.*" This is a heritage from the days when only a small percentage of engineers were technically trained, whereas, today one can hire all the designers he requires for from \$250 to \$300 per month. It is this old idea of designing something that has led to the miscellaneous collection of tie plates and spacings of drillings on rails that we find in this country.

With a research organization under the direction of the American Railway Association much of this foolishness could be done away with. This would mean a reduction in the cost of rails, tie plates, joints and frogs, as they could be manufactured and carried in stock. There is much unnecessary expense under present practice, with absolutely no excuse for its continuance. Much has been done to improve the situation by the American Railway Engineering Association, but it can only recommend, while the American Railway Association can, through its official representation, come pretty near making its recommendations *compulsory*, and that is what is needed.



A. Section of the Moffat Tunnel in Solid Granite

Getting the Most Out of



Mechanical Tampers Secure Uniform Tamping Cheaply but Must Be Kept Busy to Secure a Proper Return on the Investment

THE supremacy of the United States in industry is not the result of mere chance. It has its foundation in the intelligent, organized and well-directed energy of its people. The fear of over-production has been discounted time and time again by the enlargement of output by the greatest of our manufacturers in periods when existing demands seemed already to have been completely supplied. Witness the automobile industry.

Indeed it is not necessary even to have the demand; the placement in the market of novel products that give pleasure, knowledge and profit at prices made reasonable for our citizens of average means by the efficient conduct of factory operations has been sufficient to create the demand and to establish

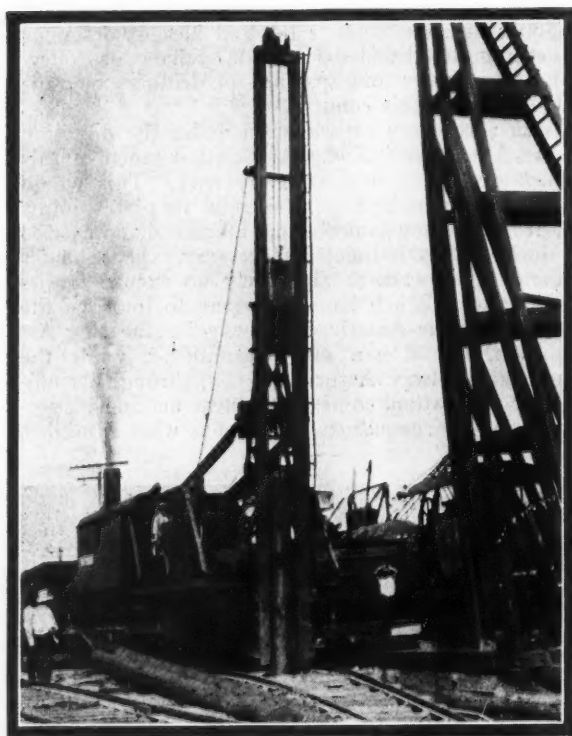
new industries at the top of the world's production. The radio and the movie are symbols of the effort.

The advanced position of this country is due to the vision, courage and energy of its leaders who recognize not only the needs but the unknown cravings of its people, and set about to supply them by exploring every resource of the universe in order to place their discoveries within the reach of every person. This is progress.

In industry it is measured in terms of increased production. Development of efficient machines, combination and correlation of facilities, enabling one workman to produce as much as many scores would without such equipment, are its foundations. On the railways it has its expression in the lowest cost per ton mile for haulage of commodities that has ever been known to mankind. Constant improvements in methods of train operation, more powerful locomotives, cars of increased capacity and added comforts for passengers are evidences of it. In the forefront of the measures that have given these results stands the adoption of labor-saving machinery and equipment for handling the bulk commodities offered for transportation by modern industry.

Work Equipment in Railway Maintenance

Railway maintenance presents its opportunities, and a review of the situation that exists in this field shows that tools and machines of most modern invention and development have been introduced there. Increased production might have been expected to follow and to continue almost automatically as in the factory and shop, where the rating of the machine is the measure of the output, and not the efficiency or inefficiency of any certain employee. But in maintenance of way this is not thus. The machine and the tool are of necessity mobile. They move to the



The Track Pile Driver and the Weed Burner Perform Their Work With a Minimum of Labor



Work Equipment

The Return Earned on Investment
Depends Largely on Ability
of Maintenance Officers to
Eliminate Idle Time

By C. C. COOK
Maintenance Engineer
Baltimore & Ohio, Baltimore, Md.

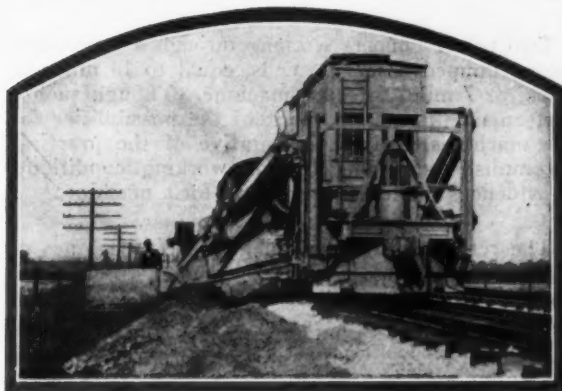
job—not the job to them. However, with careful planning and efficient performance of work progress here is equally well assured.

The kind and character of equipment in use are well known to those who read this article. The economics secured are as varied as the intensity of application of the different units. It may be trite to state, but it nevertheless is the outstanding feature of the use of any equipment in maintenance of way work, that *the regular and continuous operation of machines is the essential justification for investment and the one assurance of economy from their service.*

Variations in length and continuity of service result in differences in cost of performance and in savings effected. Failure to keep equipment consistently in use frequently results in increased rather than decreased costs. In that case the money invested becomes a loss, and the machines unjustly discredited. Fortunately the latter condition does not necessarily ensue, for the measure of efficiency of the machine itself may be determined by time studies of individual performances in a regular continuous working period. Having its efficiency thus established, the losses suffered, if such there be, must be attributed to management or man failure in assignment and use.

Let us look at the investment in equipment and the possibilities in saving in some of the major items of maintenance of way.

Only in recent years have substitutes for hand labor in surfacing track been widely accepted. The pick in stone ballast and the shovel in gravel had been universally used. Today we find pneumatic and electric tampers in general use on stone ballasted railways, and a more limited use of mechanical tam-



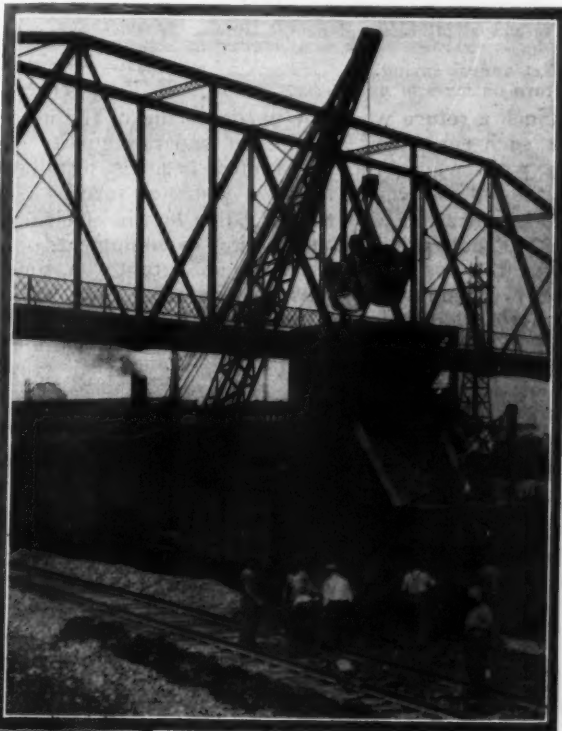
The Spreader Widens Banks Rapidly and Cheaply

pers and other special tools on gravel and cinder ballasted lines in an endeavor to secure better surfacing with a smaller expenditure of human energy.

The advantages and the economy of these power tampers are evident in observations of work done under similar conditions during the past season. The following include pick tamping, four-tool pneumatic, and four-tool electric tampers working in stone ballast. The costs, summarized, were:

	Cost per Tie End	Cost per Track Mile
Pneumatic and electric..	5.5 cents	\$327
Pick	8.0 "	477

Saving by power tampers.....\$150 per mile



These Devices Lighten the Labor in Ballast and Effect Savings in the Cost of Track Work

Two power tampers working through a six-months period tamped 82,000 tie ends, equal to 14 miles of track, or 7 miles for each machine. Though such a performance is not the limit of the possibilities for the machines, it is representative of the practical accomplishment under normal working conditions. It evidences the following saving for a machine:

7 times \$150, or \$1,050 per year.

The return on an investment in 100 machines of this character, such as may be applied consistently on many roads or regions of the larger systems, is apparent in this statement:

Cost of 100 four-tool machines.....	\$262,500
Yearly labor saving.....	\$105,000
Annual interest and depreciation.....	38,000
Net annual saving.....	\$ 67,000
Return on investment.....	25 per cent

It is commonly agreed that the work done by power tampers is more thorough and uniform, resulting in added savings in maintenance through the postponement of the need for re-surfacing, and in other advantages that accrue to railway operations through the maintenance of longer continued uniform surface conditions.

However, one should note the dangerously close margin between savings and loss in the operation of these tampers. With laxity in attention to assignment and service of these machines the season's output may readily fall to three miles per machine. The statement would then show:

Investment—100 four-tool tampers.....	\$262,500
Yearly labor saving, $100 \times 3 \times 150$	\$45,000
Less annual interest and depreciation.....	38,000
Net annual saving.....	\$7,000
Return on investment.....	2 per cent

Such a return would be unconvincing of the need for such equipment, despite the superior quality of the work which, though granted, is not susceptible of tangible statement in items of money saved.

As contrasted with this probable loss in efficiency due to inattention to application of equipment, observe the possibility of maximum output: A time study of an average performance where the work was so organized that tampers worked throughout the day, with 15 per cent unavoidable detention, showed the following result:

Four-tool machine—170 ties per day.

With the preparatory work (cribbing, jacking, etc.) so arranged that this machine could be kept working continuously, say 25 days for a seven months period, there would be surfaced:

$7 \times 25 \times 170 = 29,750$ ties, or 10 miles of track.

Carrying through the preceding form of statement of costs, this resolves to:

Net annual saving, 100 four-tool tampers	\$112,000
Return on investment.....	42 per cent

The responsibility of those to whom these machines are entrusted is clearly demonstrated by these illustrations.

The power tamper manufacturers are solving the need for machines of universal use by producing lighter and more compact units, readily transportable for spot surfacing as well as for surfacing-lift work. For multiple track lines and in situations where out-of-face work is continuous and predominant, the 12-tool tampers are available and preferred.

A reference is given here to the efforts being made to expedite and improve surfacing in gravel and other soft-ballasted track. Several power tamper

units have recently been developed and are offered in this field. There is a large opportunity for the improvement of methods of surfacing here, both in spot work and out-of-face lifts.

A Small Investment with Large Returns

That it is not always necessary to invest in expensive machines or tools in order to develop economical methods has been demonstrated by the adoption and use of a hand tool called an end tamping trowel used in spot surfacing soft ballast. It consists simply of a blade of saw steel 34 in. long by $3\frac{1}{2}$ in. wide, with a trowel handle, which is used to place ballast beneath the tie by sliding it from the end. (See description in *Railway Engineering and Maintenance* for May, 1927, page 201.) It makes use of the already solid bed on which the tie has rested, thus giving a minimum disturbance of track during re-surfacing. The results as to quality are equal to and superior to those secured by shovel tamping, which requires breaking down of the old bed. Numerous observations during the past two seasons have shown that from two to three times the amount of surfacing done with shovels can be done with end tamping trowels.

Many roads could make effective use of 1,000 of these tools. Note the investment and the return possible during a year throughout which such tools could be used to the relatively limited extent which the restricted number of situations requiring their application would, in practice, demand:

Cost of 1,000 end tamping trowels.....	\$ 1,600
Annual surfacing 250 mi. at \$120.....	\$30,000
“ “ “ with shovels at \$300.....	75,000
Saving.....	45,000
Less interest and depreciation on 1,000 tools.....	500
Net annual saving.....	\$44,500

The remarkable possibilities exemplified by these figures are realized by those foremen who have made use of the trowels that have been supplied. Equally as remarkable inefficiency and inferior track conditions are exhibited by those foremen who received their trowels and kept them upon their tool house shelves.

Track Liners

Another instance of a tool giving large returns upon the investment where it is kept in service is the track liner. One of the more efficient types in use last season showed the following economy:

	Cost per Track Mile
Lining with bars.....	\$11.10
Lining with liners.....	7.00

\$ 4.10 or 37 per cent

Applying it to a system or region where 150,000 hours had been used in lining track of a kind that could have been handled by track liners, savings could have been effected as follows:

150,000 hr. \times 37 per cent at 44 cents.....	\$24,420
Less interest and depreciation, 2,000 liners.....	3,200
Net saving per year.....	\$21,220
Cost of 2,000 liners.....	20,000
Return on investment.....	106 per cent

The above contemplates the distribution of 2,000 liners to section gangs, providing them with tools for use in their respective territories when and as occasion arises for lining where they can be used. The greatly increased power in this tool in comparison with a lining bar enables three or four men to

throw track without digging away from the ends of ties. Under a similar condition of track, with lining bars it would be necessary to use double gangs of that size and then clear away from the ends of ties to prevent the track to be thrown.

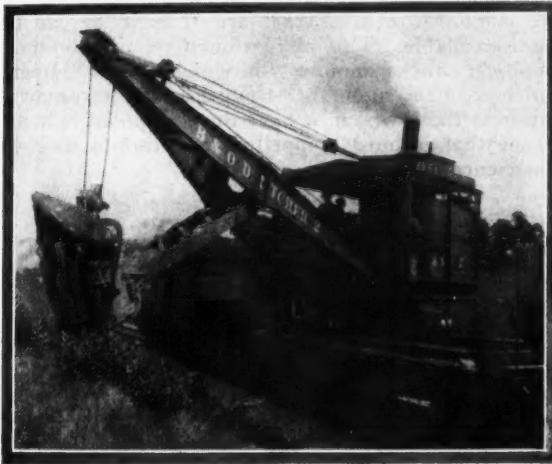
Here is required simply a forward look on the part of those responsible for supply and use of efficient tools in order to reap extraordinary results in the conduct of work.

Locomotive Cranes

Locomotive cranes have power equal to 100 to 250 men. Their maximum economy is derived when they are used on work where they replace workmen in mass. In maintenance one most prolific source of economy comes from their use in cleaning stone ballast. The organization for the maximum saving and return upon the investment is shown by the following instance of four cranes and car ballast screens:

Cost of four cranes and screens.....	\$56,000
Annual cleaning, 44 miles of double track in 112 working days at \$473 per mile	\$20,812
Same with hand forks and hand screens..	93,720
Saving	\$72,908
Less interest and depreciation.....	6,500
Net annual saving.....	\$66,408
Return on investment.....	118 per cent

Here again possible savings may be sacrificed by the lack of attention to the assembly and assignment



Steam Ditchers Pay Large Returns on the Cost

of adequate equipment. If only one locomotive crane was used in the work train in place of four as economy demands, the preceding statement would show:

Cost of one crane and screen.....	\$14,000
Annual cleaning, 11 miles of double track in 112 working days at \$1,110 per mile	\$12,210
Same with hand shovels and screens at \$2,130 per mile.....	23,430
Saving	\$11,220
Less interest and depreciation.....	1,620
Net annual saving.....	\$ 9,600
Return on investment.....	68 per cent

This is still a considerable return, but is limited by failure to assign the more economical number of machines and thus secure the utmost from the mechani-

cal equipment, and relief of labor for other track work.

Ditchers

The average cost of a steam ditcher is \$12,000. In ordinary maintenance work it will perform as shown by the following:

Moving 25,000 cu. yd. at 21c.....	\$ 5,250
Same by hand and by team at 75c.....	18,750
Saving	\$13,500
Less interest and depreciation.....	1,400
Net annual saving.....	\$12,100
Return on investment.....	100 per cent

It is following a path of least resistance to permit these ditchers to be diverted to varied and sundry jobs, such as picking up a rail, a frog, some scattered bridge lumber or signal material. However, complete loss of the efficiency which these machines are



Three Men Can Line Track With Track Liners

designed to give will likely occur. Persistent supervision to insure continual application to their major duty in their special job of ditching or other work of equal bulk is needed to realize maximum economy.

Spreader Cars

The item of ditching serves to demonstrate the value of spreader cars and the justification of investment therein. On most middle western and south-western lines side ditches are formed most acceptably and economically by the use of these machines. They are also largely used on the seaboard and mountain lines.

One machine costs about \$17,000. In ditching and spreading in a season of maintenance work, it too will handle 25,000 cu. yd. of material. The unit cost is quite low, averaging approximately 11 cents per cubic yard. Comparison with hand and team work will show the following net results:

Net annual saving.....	\$13,000
Return on investment.....	77 per cent

Weed Burners

Weed burners are of two principal types (1) those built in standard railway equipment and (2) those built on track motor car equipment. Economies from the more intense burning and rapid movement of the train in the first instance are offset by savings in train operation effected by the second. Both types have shown extraordinary savings, compared with hand methods of removing weeds.

The following statement of performances during the past season is indicative: (The hand weeding is

estimated for a condition approximately similar to that handled by the burners.)

	Stan'd Rail'd Equip't Burner	Motor Car Burner	Hand Weeder
Time operated.....	18 days	40 days	
Miles of track burned	467 miles	440 miles	
Fuel oil used.....	41,875 gal.	19,825 gal.	
All costs	\$4,357	\$2,942	
Cost per mile.....	\$9.30	\$6.70	\$57 (est'd.)

It is to be noted that similar conditions of weeds and operating circumstances never exist; for this reason the efficiency of one type of machine compared with the other cannot be determined definitely by this statement. It is sufficient to show, however, that the adaptation of machine burning does result in an approximate saving of \$50 per mile in comparison with methods of removing weeds by hand. During a season when 450 miles of track are cleared, a machine representing an investment of \$7,000 (including a fuel supply tank car) will effect a saving of $450 \times \$50 = \$22,500$, or a return of 320 per cent.

As a practical proposition, it is known that hand weeding would not extend over all the trackage covered by the machines. The return of 320 per cent is represented partly by an actual reduction in weeding expense and partly by a cleaner railroad.

The assurance of this return and these results rests with those on whose territory the machine is used for the period of its assignment. Interference with the movement of equipment, failure to keep the machine in proper repair, neglect in the maintenance of a supply of fuel oil or other materials may cause delays which completely offset the savings effected during the limited operating periods.

For all of the many other special kinds of equipment now in use in track, bridge, building and signal maintenance, statements could be prepared showing the extensive investment by the railroads of the country. Correlatively, a varied assortment of per-

formances would appear from studies of their use and a consequent variety of economies, ranging from actual losses to extraordinary savings. Few, if any, types of equipment come into extended use on the railroads or, for that matter, in any industry, until they have been given intensive trial to determine their economy in practical operations. It can then be said safely that the efficiency of labor-saving equipment now found in generous distribution on the railroads depends wholly upon the supervision and use given it by those maintenance of way forces to whom it is entrusted.

The details of costs and savings on the several types described in this article are simply an indication of the need for the consistent and regular application of available equipment whenever and wherever its use will enable a saving of manual labor to be effected sufficient to warrant the assignment. Adequate programs of work, prepared in time to provide for the assignment of equipment, and so scheduled as to give progressive movement of the larger machines so as to keep them continuously employed throughout the season, are essential. Conditioning of equipment during the off-season so that it is in excellent repair at the beginning of the working season, and is maintained properly throughout that period is another necessity.

Above all, there is the need for the co-ordination of efforts of supervisory officers and foremen to the end that for every job whereon labor-saving equipment can be used, quality of work improved, and costs reduced, there shall be put and kept in service the machines or tools that are at hand or can be made available. This obligation to secure for their employers the economies for which the investment had been made upon the strength of the recommendation of those who now have the equipment in hand, is one that is most compelling and cannot in good conscience be neglected.

What Are the Undeveloped Fields in Labor Saving?

OUTSTANDING progress has been made in the development of labor saving equipment for engineering and maintenance of way service, particularly in recent years. At the same time the number of new devices that are now being introduced and the number of improvements that are being made to established equipment indicate that the trend towards mechanical aids has not yet reached its limit.

Even more conclusive is the fact that an army of nearly a half million men was employed in the maintenance of roadway and structures last summer. Furthermore more than one-half of all the money expended for the repair and upkeep for the roadway and structures goes for labor—a proportion far greater than that prevailing in many of the most efficient industries today. If the railways are to continue to meet the increasingly exacting demands of the public for improved service at lower rates, they must do so by reducing the costs of their operations through the substitution of mechanical for manual methods.

For the purpose of bringing out the more pressing

needs for labor-saving equipment that are yet unfilled, letters were addressed to a small group of maintenance officers asking them for expressions of their opinions regarding the greatest unfilled need in the way of labor-saving equipment today. Replies from these men are printed below.

Tie Tamping and Tie Renewal Equipment Needed

By J. R. W. DAVIS
Chief Engineer, Great Northern

Our track men feel the need for a machine designed to handle tie tamping tools in multiple and to be so built that it can be operated by one man. A large sum of money is expended annually in surfacing track, but up to the present time the manufacturers of mechanical tampers have been unable to design a machine whereby an operator can handle more than one tamping tool.

Next in importance is a tie changing machine that will pull old ties from the track and the replacement ties into place in a simultaneous operation. The changing of ties and the surfacing of track constitute the hardest work that maintenance of way em-

ployees are called upon to perform. When this work is done by machinery, not only will it be possible to effect a marked saving in labor but much of the drudgery will be taken out of maintenance work. There is also a need for many other machines such as one to score and adze ties in track, for use in connection with rail relaying work and a bolt tightening machine with sufficient power to disconnect rails that have been removed from track.

Refinement of Existing Equipment Needed

By PAUL HAMILTON

Assistant Chief Engineer, Cleveland, Cincinnati, Chicago & St. Louis

The largest number of men employed in maintenance of way work are engaged in such operations as laying rail, renewing ties, applying ballast and surfacing track. The greatest need, therefore, from a labor-saving standpoint, is for equipment that will

for the handling of bolts and spikes. Outside of equipment of this character, the field seems pretty well covered, although there is, of course, still room for improvement in all lines.

Make Better Use of Equipment Now Owned

By R. H. HOWARD
Chief Engineer, Wabash

The greatest need today in the way of labor saving equipment is not so much the invention or development of additional labor saving devices, as the full use of the equipment that has already been developed. During the last few years great steps have been taken in the development of labor saving devices, such as power tamping equipment, improved ditching machinery, ballasting machines, oiling machines, paint spraying equipment, etc., and the progress made in the development of this machinery has been so rapid that most of the railroads have not been



A Not Unusual Scene, Yet One Which Involves a Large Waste in Labor

perform these operations satisfactorily and economically. Devices are now available for all of these operations but none of them has yet been developed to the point where they will do the work in the way that will result in the maximum economy. The crying need today is for the further refinement and development of tools and devices for doing work of this character in an efficient manner with the fewest possible number of men.

A Track Skeletonizer Needed

By G. A. PHILLIPS

Engineer Maintenance of Way, Lehigh Valley

The device that we most urgently require today is a portable inexpensive machine, that can be removed from the track easily and quickly and that will remove foul ballast from between the ties and deposit it on either side of the track or on multiple track lines, preferably between them.

Equipment for Track Work Needed

By L. H. BOND

Engineer Maintenance of Way, Illinois Central System

Our people are greatly interested in labor-saving devices and it is our practice to investigate every device that seems to have merit. As far as the maintenance of way department is concerned, our greatest need is for some device that will aid in maintaining the track structures directly. There is still considerable room for improvement in tie tampers, ballast cleaners, rail layers and machinery

able to take full advantage of the equipment that has been offered.

A very large saving in labor can be made if the railroads will intensively supervise and educate their men in the use of the labor saving equipment that is already available.

Need Equipment to Clean Ballast

By ENGINEER MAINTENANCE OF WAY

The greatest need in the field of labor-saving equipment at the present time is a device for cleaning ballast. Drainage is one of the most important requisites of track. With the increasing use of locomotive stokers and with the constantly increasing coal traffic the ballast fouls quickly, allowing the increasingly heavy motive power to exact a heavier toll of the track, thereby increasing the amount of maintenance required, which of necessity, requires manual labor.

The cleaning of ballast by hand is generally deferred for other ever-necessary work, whereas where mechanical means are available, the work progresses more regularly. In addition cleaner ballast is produced, allowing the water to run off more readily and reducing or eliminating the so-called pumping track, which tends to shorten the life of rails and ties. Clean ballast also contributes to the smooth riding quality which is so essential to present-day track, and in addition, materially reduces the number of men necessary to keep the track in surface, gage and line.

Of course, volumes could be written and much

information collected to show the importance of drainage, but it is generally recognized that the cleaning of ballast and keeping it clean will give a railway greater returns on the money invested than any other item of roadway maintenance.

Equipment Must Be Kept Busy

By EARL STIMSON

Chief Engineer Maintenance, Baltimore & Ohio

The field of labor-saving equipment seems to be fairly well covered; that is to say, some kind of a machine has been produced for doing almost every kind of work there is to be done in the maintenance of way and structures. This does not mean that the end has been reached. This is a day of great inventive activity and improvements in machinery already in use and the introduction of new equipment now unthought of may be expected.

The present economic conditions demand greater production at less cost. The industries have met these demands by the use of machinery and shop management. Railway maintenance is to a large extent a problem of labor and offers a great opportunity for increased production at less cost by the use of machinery and good management.

Many efficient machines are available for this purpose and a number of railroads have invested quite heavily in this class of equipment. The records show that they have received large returns on their investment.

The handling of the equipment so as to get the maximum results from it is of as great importance as having the machines. If the machines are not properly handled and their work scheduled so that they will be in operation with the least interruption, they may become a source of expense instead of savings. A machine, to be a labor-saving device, must be kept busy. The more expensive the machine the more this applies, as the interest on the cost and the depreciation go on whether the machine works or not. It is my experience that the greatest need in labor-saving equipment and machines is to keep them busy.

Equipment Needed to Reduce the Work

By JAMES F. BURNS

Assistant Engineer Maintenance of Way, Louisville & Nashville

While inventive talent will develop machines in the future to do work now done by hand, this development will be to avoid the necessity of doing work, rather than toward developing means of doing it. In recent years we have seen the development of equipment to do many classes of railway work, including motor cars, mowing machines, weed burners, tie tampers, paint sprayers, ballast cleaners, rail layers, welding outfits, drilling machines, ditching machines, grading machinery, ditcher-spreaders, snow melting devices, cranes and derricks, long time switch lamps, etc. As the field for machinery seems pretty well covered I do not anticipate that the development of the future will be as much in new devices to do various classes of work as in the increased use of such devices and their adoption, to the end of abolishing or avoiding the need of much work heretofore done by hand-labor.

Take for instance the ditcher-spreader which will do work under conditions where hand labor cannot work or at a fraction of the cost. The saving made by using a ditcher-spreader under ordinary conditions may be \$175 per day or the labor of 70 men.

This in turn effects a saving in track maintenance, with longer life of ballast, ties, rail, etc. Without the ditcher-spreader much of the work that now may be done economically may not be done at all while each year the same cuts would be ditched in the same unsatisfactory way with no permanent improvement of roadbed or track conditions.

I believe that the greatest return on the investment, under average conditions, comes from the ditcher-spreader. From the beginning of railroads, drainage has been the great problem and with the constant increase in the weight of equipment the problem remains a large one. Heavy equipment has introduced the problem of drainage of water pockets by sub-surface channels. In many cases the expense would have been avoided if the surface water had had an outlet through a proper surface ditch. Instead it has sunk into the roadbed, softened it, permitting the ballast (especially if rock) to be pounded down into the subgrade and reduced the effectiveness of the ballast.

A Permanent Roadbed

By W. J. BACKES

Chief Engineer, Boston & Maine

Our greatest need today, from a labor-saving standpoint, is a more permanent roadbed. I have felt for the last ten years, that our next big step forward in maintenance would be in the development of a permanent roadbed construction. The principal deterrent which has stood in the way of this development has been the large initial capital expenditure necessary. I believe that the experiments that have been made recently are steps in the right direction and that when the fundamental principles of this construction have been established, economy in design and in building will follow quickly.

B. & M. and M. I. T. Establish Joint Course in Railroad

THE creation of a cooperative course in railroad operation, combining scientific instruction at Massachusetts Institute of Technology, with fundamental practical training on the Boston & Maine, has been announced jointly by the institute and the railway. This new course, which has been under consideration for nearly a year, will be carried out under the department of civil engineering of the institute, and will consist of four years of undergraduate instruction, one summer camp, a full year of postgraduate work, and one special summer term. Dovetailed with this technical instruction will be a year and one-half of practical employment on the B. & M., the two parts of the course alternating at intervals after the second year of undergraduate instruction.

The course will include the fundamental subjects of civil and electrical engineering, such as bridge construction, earthwork, and electrical equipment, the latter subject including signals, communication systems and train lighting, as well as the characteristics of terminal and trunk line electrification. Much time will also be given to the study of passenger and freight traffic, steam locomotive operation and maintenance, auxiliary means of transportation, and railroad accounting and administration. In obtaining the practical side of the training, those taking the course will be employed for limited periods in the engineering, mechanical, operating and executive departments of the Boston & Maine, receiving a definite monetary compensation for their time while they are learning the details of the work.

Keeping Work Equipment in Service

Attention Must Be Given
to Maintenance If a Full
Return Is to Be Secured
from the Investment

By C. R. KNOWLES *

Superintendent Water Service
Illinois Central

THE USE of labor saving equipment has increased tremendously on the railways of America during the last 10 or 15 years. Investments totaling hundreds of thousands of dollars for equipment of this kind are not unusual on the smaller railways while on the larger roads they run into millions of dollars.

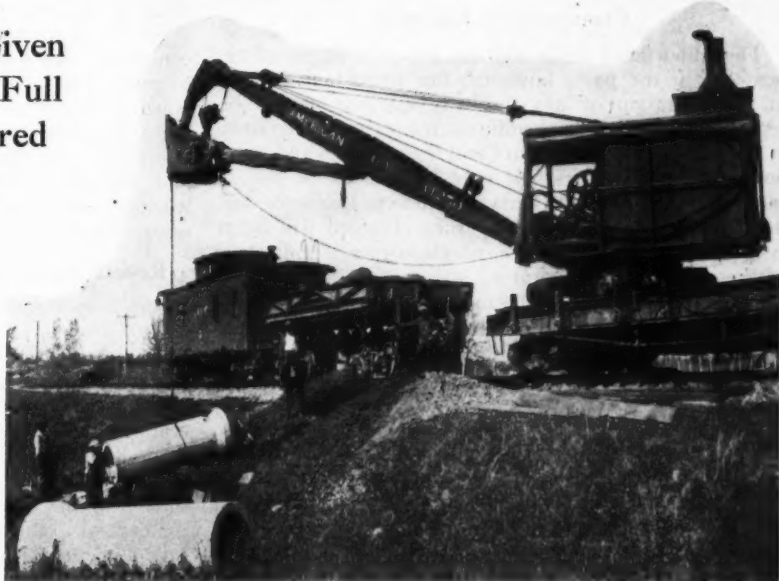
As an illustration of the amount of equipment used in maintenance of way work, a middle western road has a total investment in work equipment of \$1,500,000, of which \$450,000 represents the value of motor cars alone. Again, the larger units alone on 3,500 miles of the New York Central Lines east of Buffalo represent an investment of \$3,750,000, while, if other items of smaller equipment are added, the total investment exceeds \$4,000,000. Therefore, the other railways of the country need be only half as well equipped in proportion to their mileage as this portion of the New York Central to involve an aggregate investment in work equipment on all roads in excess of \$400,000,000. There is no question but that the results obtained justify the expenditure for labor saving and work equipment, both in reducing the cost of doing work and in making possible more efficient results if the equipment is selected wisely and properly maintained and operated.

Facilities for Maintenance Are Essential

To secure the maximum return from the use of equipment of this kind it is necessary that it be ready at all times for the service required. One of the principal factors to this end is proper maintenance. Too often the fact is overlooked that the equipment requires upkeep attention to permit of its being used to the maximum efficiency. The acquisition of additional work equipment by the railways in recent years has exceeded the existing facilities for proper maintenance, and in many cases the necessity for providing means for making repairs has been lost sight of.

Consideration should be given to the maintenance of equipment at the time it is purchased. No matter how efficient a machine may be it is only a question of time when it will require repairs and unless provision is made for timely, efficient maintenance the results will, in all probability, prove disappointing. It is not to be expected that all work equipment will render service 100 per cent of the time, as even with the most efficient op-

*Mr. Knowles is also in charge of the maintenance of work equipment on this road.



Machines Should Have Careful Operation to Keep Them in Good Order

eration and maintenance there will be times when interruption is unavoidable, but proper attention to maintenance will insure the maximum service possible and reduce delays to a minimum.

Many manufacturers maintain service organizations to follow up their equipment and assist the roads in its maintenance. While this service is of value it cannot be depended upon to take the place of a well organized system of direct maintenance by railway forces.

The maintenance of work equipment can be divided into three general classes:

1. Ordinary running repairs or field maintenance.
2. General repairs.
3. Breakdowns or emergency repairs.

Field Maintenance

Running repairs, or ordinary field maintenance, are of perhaps first importance. They begin with the intelligent operation and care of the equipment for the proper operation of the machine carries with it minor details of every-day maintenance that tend to prevent breakdowns and greatly lengthen the period between general repairs. Certain features of maintenance are so closely allied with operation that it is impossible to draw a definite line of demarcation. Among these details are proper lubrication and adjustment of the machine. Actual repairs coming under the head of field maintenance include packing, the adjustment of moving parts and the replacement of minor parts of the machine, which can be done in most cases by a competent operator without actually taking the equipment out of service.

General Repairs

General repairs must, of course, be performed at central points and require the taking of the machine out of service for a period of time. Much of the work done by equipment of this kind is seasonal, which provides ample time for general overhauling or other heavy repairs at a time when it is not actually required for service. Even when such equipment is used throughout the year it is rarely ever in constant use. Therefore,

a definite program of maintenance will result in the equipment being maintained in readiness for service at all times.

Cleanliness Is Essential

The importance of cleanliness has been stressed repeatedly in the past; however, this important feature in the operation of any roadway machine cannot be repeated too often, as cleanliness is a primary requisite in keeping down field repairs and breakdowns and postponing general repairs. It may be possible to secure satisfactory results with dirty and ill-kept machines, but the probabilities are that the results obtained will be in keeping with the appearance, which in turn is indicative of the ability of the operator.

Regular inspection of the machine at stated intervals adds to its life and will do much to prevent breakdowns and accidents. Frequent inspection is particularly essential in equipment propelled by its own power, as the possibility of serious accident is much greater with such equipment than with other types. In fact, it is generally recognized that frequent inspection is essential for safety in connection with all equipment traveling under its own motive power, and the same rule may well be applied to all equipment in the interests of safety and of uninterrupted operation. It is difficult to differentiate between inspection and cleanliness as they go hand in hand. A thorough inspection naturally follows systematic cleanliness for when the machines are cleaned regularly and thoroughly inspection becomes a part of or automatically follows the cleaning operation.

The operator of any machine should have a thorough knowledge of the construction of the machine and sufficient mechanical ability to make field repairs, not only for reasons of economy in maintenance but because of the time saved by making repairs immediately instead of waiting for a repairman.

The care of equipment when not in use is an important factor in its maintenance, second only to actual repairs. Unless it is properly cared for when not actually in use the deterioration may be even greater than that resulting from constant use. These comments, of course, apply chiefly to seasonal equipment. Neglect to take proper care of this equipment when tied up may result in deterioration that will more than offset any saving resulting from its use.

Repair Shops Should Have Separate Organization

General repairs necessitate the establishment of maintenance of way repair shops, which should, in every instance, be independent of the regular locomotive repair shops. This recommendation is no reflection upon the ability of mechanical department forces but is made for the reason that men engaged in the repair of locomotives and cars are not familiar with the different types of work equipment unless a regular department with a separate personnel is assigned to this work, which is seldom possible or practicable. Therefore, when repairs to labor saving equipment are assigned to mechanical department forces the personnel engaged in making the repairs is constantly changing, with the result that the mechanics do not become familiar with the equipment and are not vitally interested in its proper operation. Their interest naturally lies in the maintenance of locomotives and cars, which is an entirely different class of work. The power used in operating labor-saving equipment is largely internal combustion engines and its proper maintenance necessitates employing mechanics specially trained along this line.

Where shops are established for general repairs they should be equipped with modern equipment, tools and

machinery, and if not located in close proximity to a storehouse, a sufficient stock of parts should be maintained in conjunction with the shop to avoid unnecessary delay in making repairs. The location and number of shops for making general repairs will depend upon local conditions and requirements. The force should consist of competent mechanics in the shop and traveling repairmen where required. The operation and maintenance of all equipment should be under the direction of one man, who should have sufficient executive ability and mechanical knowledge to supervise properly the work of repairs in the shop as well as the general maintenance and operation in the field.

Repair Equipment Must Be Selected Carefully

The proper equipment of a repair shop for the great variety of devices used in maintenance of way work is a process of development in both equipment and personnel. The equipment handled by a shop of this kind will cover the entire range of maintenance of way operations from derrick cars to paint sprayers, and it is not to be expected that such a shop can be built, equipped and manned over night, or that the equipment and personnel on one road will be ideal for another road. On the contrary each shop should be carefully developed in such a manner that it will meet the requirements of each individual road.

In many cases the existing maintenance of way repair shops are poor affairs, consisting of old car bodies or discarded shanties with few tools and practically no equipment, taken over for use when the repairs were confined to a few motor cars. It is a serious mistake to depend on so-called shops of this type for maintenance. Where such shops exist they should be expanded, developed and perhaps relocated. A very important consideration in connection with the location of a maintenance of way repair shop is that it be so situated that it can be served by a track for loading and unloading purposes as well as for testing track equipment sent in for repairs.

Emergency Repairs

The third class of maintenance, embracing breakdowns and emergencies, cannot be anticipated, although such breakdowns can be reduced to the minimum by careful and intelligent supervision.

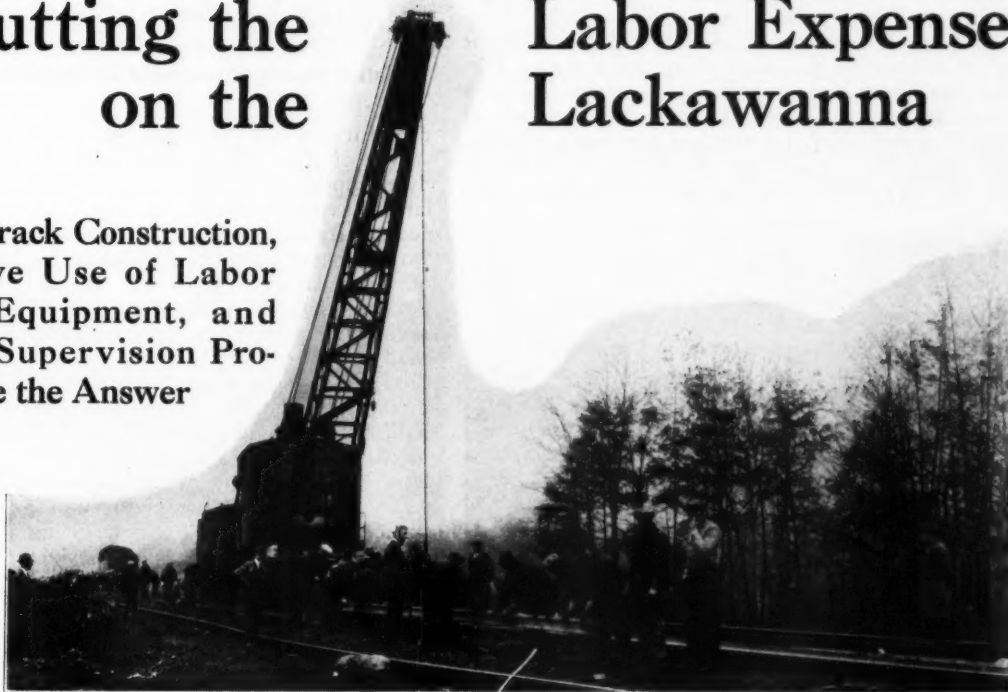
As already stated, it is almost impossible to draw a definite line of demarcation between maintenance and operation as one is dependent on the other. Therefore, it is essential that the maintenance forces and those in charge of the operation of the equipment be a part of the same organization, sharing equal responsibility for both upkeep and operation of the equipment. A smooth working organization of this kind, including field inspection and first aid service will insure maximum return from equipment. This is particularly true of such units as motor cars, which as a general rule must be ready for service at all times.

Many interruptions to service with work equipment result from comparatively trivial matters. For example, three pneumatic tie tamping machines equipped with four tampers each and 2,160 ft. of hose became inoperative through the failure of an inferior grade of hose. The difference in the cost of the hose used and hose of the proper grade was \$43.20, yet it resulted in shutting down four machines representing an investment of about \$24,000 for several days until the proper hose could be furnished. It is easy to see that there was no real economy, for although the first cost represented a slight saving, it led to an expense far in excess of the difference in the cost of the proper hose.

Cutting the on the

Labor Expense Lackawanna

**Heavy Track Construction,
Extensive Use of Labor
Saving Equipment, and
Efficient Supervision Pro-
vide the Answer**



Locomotive Cranes Facilitate the Laying of Heavy Rails

WITH labor the largest single item in railway maintenance, much attention has been given by engineering and maintenance officers in recent years to the problem of reducing this expense. Many roads have been developing labor saving policies to an admirable extent, and can point directly or indirectly to large economies, but it is doubtful if any road has taken a more prominent part in this movement than the Delaware, Lackawanna & Western, which has been a pioneer in adopting many labor saving methods and practices.

In its full sense, there are two distinct meanings of the term "labor saving" as applied on a railroad—an actual saving in the man hours employed, and an actual saving in the physical energy expended in performing work. The Lackawanna has interested itself in both of these phases of labor saving, and from its experience, has found that they are entirely compatible, resulting not only in a reduction in the cost of maintenance work, which is carried out more expeditiously and effectively, but also in a higher morale among the maintenance forces.

A number of interesting methods are employed on this road for saving labor and for reducing maintenance costs, but a study of its policies and methods shows that practically all of these can be grouped under three main heads: permanence of construction, the use of labor saving equipment, and the maintenance of an efficient, satisfied, and closely supervised maintenance of way organization.

Heavy Track Construction Saves Labor

One of the oldest axioms in railway work is that one must spend money to save money, just as one must spend money to earn money. It is a lesson that must be learned and a policy that must be followed before a road can expect to exhaust the full possibilities in saving labor. The Lackawanna has learned this lesson and has put it into effect

where reason and experience have shown justification. In many instances it has pioneered in labor saving development, and so continues at the present time in carrying out practices with the view of reducing maintenance costs—not necessarily during a current year, but of larger importance, in the long run over a period of years.

One of the most potent examples of the labor saving practices of this road is to be seen in its type of track construction and track maintenance: treated ties, ample depth of rock ballast, 39-ft. rails of heavy section, large tie plates, anti-creepers, and four spikes in each tie plate, two screw spikes to hold the plate to the tie, and two cut spikes to hold the rail in place. The result is an unusually strong and durable track structure which will withstand the continual batter of heavy traffic without complete overhauling at frequent intervals. It is true that such a track structure is more expensive to install, and increases the roadway fixed charges, but it has been demonstrated effectively that in the long run these factors are more than offset by the increased life of the track materials, by providing a stronger track structure, and by the reduction in maintenance labor costs.

Treated Ties and Heavy Rail

On the Lackawanna, this theory begins with the roadbed, as is evidenced by the following remarks made by George J. Ray, chief engineer of that road, before the Roadmasters convention last fall in Buffalo, and reported in the October, 1927, issue: "So I contend, whether you are in a rock cut or in an earth cut, you ought to make your roadbed wide, so that you won't have to use the work train all the time to keep the ditches clean. The first cost is the least." Speaking of cross ties on the same occasion, the same speaker interjected the remark "and nobody should be putting ties in the track

today without treatment," which is evidence of the Lackawanna's tie policy.

As a result of these policies there is a constant saving in labor on this road along many lines. Perhaps one of the most striking examples of such savings is apparent in the Lackawanna's tie renewal records, which show for the last ten years, 1918 to 1927, inclusive, an average life of 23 years for its ties. In other words, during this period, it renewed



Heavy Construction Reduces Track Maintenance Costs

an average of only 120.4 ties per mile. More striking still is the tie record of this road for the five years ending with 1927, which shows that the annual tie renewals per mile for all classes of track was only 94.5. This has meant a saving in materials to be sure, but still more important, it has resulted in a large saving in the labor necessary for renewing ties. This has been effected not alone from treating the ties, but also from the road's policy of keeping its ballast clean and providing adequate track drainage, and from its practices of boring all spike holes before the ties are treated, and screw spiking the tie plates to the ties, independent of the rails, so as to minimize the mechanical destruction of the ties.

Heavy Rails and Fastenings are Used

Supplementing its efforts to reduce tie renewals, the Lackawanna has been studying the subject of rail renewals with the same two objects in view, saving materials, and saving labor. Thus it went to the 130-lb. rail section with correspondingly heavy fastenings, and it sprays all of the metal in its track structure with oil to prevent corrosion. It has also been looking for rail with a longer life than it is possible to secure from ordinary carbon steel, and with this in mind, has been using, since 1912, manganese steel rails on its sharper curves on heavy tonnage lines, to minimize the frequent change-overs and renewals necessary at these points when carbon steel is used. Manganese rail costs considerably more than standard open hearth rail, but justification for this additional expense is clear when it is realized that from 8 to 10 years life is being secured from this rail on curves, where ordinary rail would have to be changed over or renewed at periods of from one to two years. Evidence that the Lackawanna is securing a return on this added investment in both increased life of the rail and in reduced labor

costs for rail renewals, is seen in the fact that 500 tons of 130-lb. manganese rail were installed in its tracks during 1927.

Labor Saving Equipment an Important Factor

So throughout its track structure, permanence of construction has been an important factor in the saving of labor, the many angles of which could be dwelt upon at length. This is only one phase of labor saving methods on this road, for with its necessarily large amount of unavoidable maintenance work it has always been a leading exponent and user of labor saving equipment. In fact, it is entirely possible that the Lackawanna now has more labor saving equipment per mile of track than any other road in the country. With only 999 miles of line, this road is equipped with locomotive cranes, ditchers, spreaders, steam shovels, air dump cars, ballast cars, snow plows, flangers, ballast cleaning machines, motor cars, pneumatic tie tampers, track liners, a track oiling car, a tie scoring machine, and a large number of labor saving units of lesser importance. In fact, there are few genuine labor saving devices which have not been considered by that road where they have established their worth and could be fitted in economically and effectively with the equipment already in use. This is not meant to indicate that the road is overloaded with labor saving equipment, for this is not the case, but it is indicative of the fact that when this road has a heavy piece of work to be done, it is prepared to undertake it with time and energy-saving equipment which will effect large savings over the man-power methods formerly employed.

Take for example the motor car, one of the most common, yet effective, time and labor saving units of equipment on the railroads. The Lackawanna was one of the first roads to use the motor car extensively, and for a number of years, every section foreman on that road has been provided with a motor



Driving Cut Spikes With a Pneumatic Hammer

car for the transportation of his men and their tools to and from work on the line. In addition, every roadmaster's territory, which includes from 25 to 35 sections, is equipped with either three or four heavy-duty extra gang cars and trailers for moving large forces of men or for transporting tools or materials.

Pick tamping of stone ballast in surfacing track is

a thing of the past on the Lackawanna except in isolated instances, as every second section on the territory where stone ballast is used is equipped with a four-tool, pneumatic tie tamper outfit, and each main line division is equipped with from three to four 12-tool tampers for extra gang use. Man power for rail renewals is also giving way on this road to mechanical equipment, as locomotive cranes are used to set in the new rail and compressed air is used



Scoring Ties at a Cost of About \$13.75 a Mile

extensively for practically all auxiliary operations.

A striking example of the extent to which this road has gone in this type of equipment is illustrated in the methods used for relaying its rail during the past two winters. A tie scoring machine for definitely indicating the limits for adzing work; rail unloaders for unloading the new rail; cranes for placing the rail; pneumatic wrenches for backing off and running up nuts; pneumatic track drills for drilling rails for closures and switch work; pneumatic bonding drills; pneumatic wood drills for boring spike holes in the field; and pneumatic spike drivers for driving both screw and cut spikes. Power for all of this equipment is supplied by 12-tool, Ingersoll-Rand tie tamper compressors, which indicates how these units are used effectively during the winter months when surfacing cannot be done. Supplementing this array of time and labor saving equipment, the Lackawanna has been experimenting with an air-operated boom attachment on its 12-tool compressor units, for setting in the new rail, and thereby eliminating the use of the locomotive crane for this service. Thus, it is building up complete rail laying outfits of mechanical equipment, including pneumatic cut spike pullers, now being tried out, which are destined to speed up rail renewal work, and to effect large savings in man hours of labor and in the physical energy expended.

Devices Developed on the D. L. & W.

The Lackawanna has not only been quick to investigate and to adopt commercial labor saving devices which meet its particular requirements, but for lack of suitable or available equipment, has actually designed and developed some of its most effective labor saving units under the directing heads of its engineering department. Outstanding among these are the track oiler and the tie scoring machine, previously mentioned. The former, which is illus-

trated on page 201 of the 1926 edition of the Railway Engineering and Maintenance Cyclopedic, was one of the first practical machines devised for oiling all of the metal in the track structure, and was built by the Lackawanna to protect its rail and track fastenings from corrosion and excessive wear, and to save the large amount of labor which would be required to accomplish this work by brush or other hand methods. This unit of equipment, which consists of special spraying devices mounted on a rebuilt caboose, is still in service and operates effectively, oiling the webs, flanges and fastenings of both rails, at a rate of about 20 miles per hour.

The tie scoring machine developed by this road is one of its most effective labor saving devices. This machine, which has been in service since 1925, was described in detail in the May, 1927, issue of *Railway Engineering and Maintenance*. Briefly, it is a self-contained unit mounted on a steel frame push car, consisting of a power unit operating four circular saws, so arranged that the ties in the track can be scored to any desired depth on both sides of each rail at the same time. This makes it possible to secure accurate adzing and the correct amount of it as regards each tie, on a horizontal plane, or on any desired angle of inclination, both on curves and on tangent track. Thus the machine not only saves labor in adzing ties in connection with relaying rail, but of larger importance, it provides a true seat for the new rail, parallel with the old seat, and thereby eliminates the necessity of smoothing up the track after the rail is laid in order to secure an even rail bearing on all of the ties. These important savings



Applying Nuts With a Pneumatic Wrench

are secured at a cost of about \$13.75 per mile of track, the total expense of operating the tie scoring machine.

Condition of the Equipment

As it is the efficient operation of its labor saving equipment which is reducing the labor requirements for specific work on the Lackawanna, one of the most effective policies of that road with respect to its equipment is to keep it in good working condition

constantly, so as to preclude breakdowns with their resultant delays and loss of man hours. In carrying out this policy, there are two mechanical supervisors with assistants on the road. Each mechanical supervisor has a territory of about 500 miles, and most of their time between April 1 and November 1 is spent in traveling over the road supervising adjustments and repairs made by road mechanics to all classes of labor saving work equipment.

With the close of the heavy summer and fall work, or when the units can be spared from field work, practically every class of power-driven equipment, from all points on the road, is shipped into the company's maintenance of way department shop at Dover, N. J., where each unit is completely overhauled and repainted. Through these measures, which in the aggregate cost relatively little, the Lackawanna is assured of long life for its equipment, and maximum efficiency from the labor gangs accompanying each unit.

The third principal group into which the labor saving policies of this road may be said to be

of skilled operators, and the major adjustments and repairs are all attended to by the mechanical supervisors and their assistants who are specially qualified for this class of work. Even in the office forces, every employee down to the stenographers, is assigned to the work to which he or she is best qualified, a refinement which is not only conducive to more efficient output, but more satisfactory to the employees themselves.

Classification and Training of Foremen

As regards the track forces, it has been found that many things can be done to improve their morale, and to stimulate labor saving through a better class of work, more economically performed. To this end, section foremen were placed on a monthly salary basis. This was done in 1922, when the D. L. & W. Track Supervisory Organization was organized, composed of section foremen, extra gang foremen and student foremen, all of whom were put on a flat monthly rate and made to feel that they were lifted above the level of the regular section men.



The General Council of the Track Supervisory Organization Includes Two Foremen from Each Division

divided, refers to the organization and the personnel of its employees. Stated briefly, in the words of the principal assistant engineer of the road, it follows the theory that no one knows everybody's business, therefore every one to his own business. It believes that intelligent and adequate supervision is essential; that accurate records of performance are vital, and that as far as possible, a high class of labor should be employed and its morale kept at a high point. In all of these, it sees better physical results, more efficient labor performance, and actual conservation in the number of man hours of labor employed.

Following out these beliefs, practically every man in the engineering and maintenance department, from the directing heads down through the department forces, is a specialist in the line in which he is employed. Thus the roadway department is concerned solely with roadway and track maintenance, and except in cases of emergency, is not called upon to perform bridge and building, water service, signaling, or any other form of work foreign to its jurisdiction. Section foremen are encouraged to acquaint themselves with and to interest themselves in every unit of labor saving equipment on their territories, but the actual operation of all of the most important machines and devices is left in the hands

With equitable wage levels established for each class of foreman, based on their former incomes, including overtime, an arrangement was worked out which has proved most satisfactory to both the men and the company. In effecting this arrangement the road not only secured the fuller cooperation of its foremen, who have come to feel that they are a definite part of the supervisory organization of the road with greater responsibilities, but it actually offered a premium to the foremen to complete their work within the regular working day.

Supplementing the benefits which have been derived from this readjustment in the status of section foremen, much has been done to educate and interest these men more fully in their work. These measures take two principal forms: regular quarterly foremen meetings where subjects of timely interest are presented and discussed, and annual cash prize awards for the best maintained sections throughout the year, judged on the basis of both actual physical conditions and the actual labor costs of effecting the work.

Another method adopted, to insure a constant supply of trained foremen, was the creation of the status of student foremen. Foremen of this rating, of which there are 12 now on the road, are picked young men, preferably with at least a high school

education, who are given special training within the regular section and extra gangs with the view of making them foremen when vacancies occur. Like the section foremen, the student foremen are paid a flat monthly rate, and belong to the foremen's supervisory organization.

Among other important measures undertaken by the Lackawanna to reduce labor costs, an experiment now under way and showing promise of effective results, is worthy of mention. This is the enlarging of certain of its sections to include the territory of two former sections. Thus far, five such enlarged sections have been established, containing from six to eight miles of territory. This, of course, requires unusually capable foremen to handle the increased work, larger forces, and greater responsibility. In the end, however, it is felt that this arrangement will not only save the expense of one foreman, but it will save clerical work, give the foremen a force of sufficient size to carry out heavy work throughout the year, and when flagmen or slow orders are used to protect work, it will occasion only one train delay out on the line, where two gangs working independently would invariably cause two delays. With this experiment under way only since April, 1925, many of these anticipated economies have been effected; however, with so much dependent upon the ability of the foreman, further experiment and study is being made.

From the above observations of the methods and practices carried out on the Lackawanna, it is apparent that that road is saving labor in its track department in three principal ways; through heavy track construction, a large layout of labor saving equipment effectively operated and maintained, and through a highly organized and well trained supervisory organization.

Immigration a Minor Factor in Labor Supply

DURING the calendar year 1927, 323,885 immigrant aliens were admitted to the United States, while 75,112 aliens departed without expressing any intention of returning. Therefore, the net increase in the population of the United States due to immigration was 248,773 for the twelve months ending December 31, 1927. This coincides fairly closely with net increases due to immigration of 263,116 and 209,036 for the years 1926 and 1925 respectively. In fact, there has been no appreciable change in the trend of immigration or emigration during the past four years, nor has there been any change in legislation relating to immigration which would result in any marked change.

Four countries furnish the great bulk of the immigrants. Of these, the leader is Canada with a net immigration of 79,553 for the fiscal year ending June 30, 1927; Mexico comes next with 64,764; Germany third with 43,765 and the Irish Free State with 27,005.

An examination of the statistics showing the destinations of immigrants after reaching our shores shows that these objectives may be roughly divided into two classes, namely, the destinations of Europeans which are primarily in the states having large industrial centers and those of the Mexicans which are primarily the states along the Mexican border. Thus, we find that the six industrial states,

New York, Michigan, Massachusetts, Pennsylvania, New Jersey and Illinois received 199,764 immigrants while the border states of Texas, New Mexico, Arizona and California received 74,643. As all other states received only 60,768 immigrants and from these must be subtracted the emigration during the corresponding period, it is clear that emigration from Europe to this country is a relatively unimportant factor outside of the industrial districts. These data, however, are not conclusive since they are based merely on the statements of intention, and no check is made of the actual destinations of the immigrant after he has entered the borders of the country. This comment applies particularly with respect to the Mexicans for it is well known that their entrance across the border into the states of Texas, New Mexico, Arizona and California, is by no means evidence that all remain for any length of time in the states of entry.

"Bootleg" Immigration Upsets Statistics

Experience of the immigration authorities during the years subsequent to the enactment of legislation placing drastic limitations on immigration has shown that statistics for legal immigration cannot be relied upon as an accurate index of the number of persons who actually obtained admission to this country during these years. Illegal or "bootleg" immigration across the Mexican and Canadian borders and from the West Indies, primarily Cuba, to the shores of Florida as well as through the desertion of seamen at American ports, has resulted in the entrance of many persons not accounted for in statistics. This is no reflection on the immigration authorities since they are compelled to cope with this situation with a totally inadequate border patrol as well as with ineffectual laws covering the expulsion of the "bootleg" immigrant who has been apprehended.

Obviously there is no way of determining or even approximating the number of persons who enter the United States illegally. It is reasonable to suppose however, that they do not differ widely as to class, from those admitted within the quotas of the countries from which they emigrate and since only 24,621 persons out of the total net immigration during the fiscal year of 1927 were classed as laborers, it is clear that immigration from Europe, at least, plays a very small part in the supply of track labor.

As pointed out in the article on immigration which appeared on page 91 of *Railway Engineering and Maintenance* for March, 1927, the Mexican comprises the only class of foreigner who now constitutes an important factor in the track labor market. It is therefore of definite interest that several bills have been introduced in Congress to restrict immigration from Mexico by putting it on a quota basis. Several reasons have been advanced for this restrictive legislation, of which the most important is the fact that the Mexican is not of a white stock like the European immigrants and cannot be expected to be absorbed in the American melting pot with anything like the success that has attended the amalgamation of the immigrant from Europe. During recent months however, strenuous opposition to this proposed legislation has developed among the agricultural interests in the southwestern states who contend that restrictions on the admission of Mexicans will result in a marked reduction in agricultural production. In view of this, it is impossible to hazard any prediction as to the outcome of this further effort at the restriction of immigration.

How One Road Cares for Its Men *

Efforts to Improve the Standard of Living by Providing Substantial, Sanitary Camps, Plus Thorough Supervision Have Produced Results

By R. W. NICOL

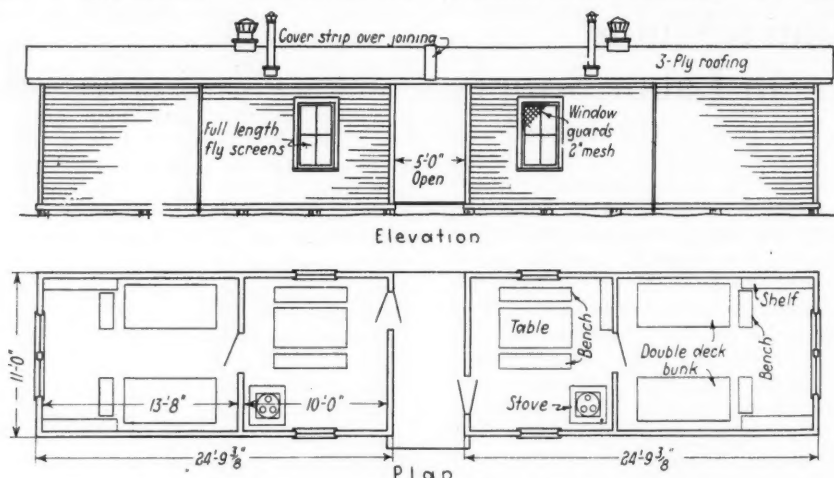
Supervisor of Labor,
Elgin, Joliet & Eastern, Chicago



A Section House Can Be Made a Real Home

THE management of the Elgin, Joliet & Eastern, like that of every other railroad, is confronted with a big problem in housing and feeding certain of its employees, and has not only given the matter careful study, but has spent considerable money in bettering the living conditions of the men who are housed on company property. We believe the time and money have been well spent, as we find many evidences of appreciation and contentment

forces on the Joliet division are made up of American and Polish laborers. We find these classes of labor more efficient than others in this line of work. Our section forces consist principally of Mexicans. All labor hired in Chicago is transported from the agency to the various places of employment in a motor coach provided for this purpose. It has a capacity of 16 men. We find this method of transportation more economical, as it results in a saving



Portable Bunk Houses Used by the Elgin, Joliet & Eastern

among the men, which we believe can be traced directly to better quality of food and more suitable living quarters. Furthermore, the labor turnover has been reduced considerably, and there is no doubt but that the major reason for this decrease is the effort put forth in this direction.

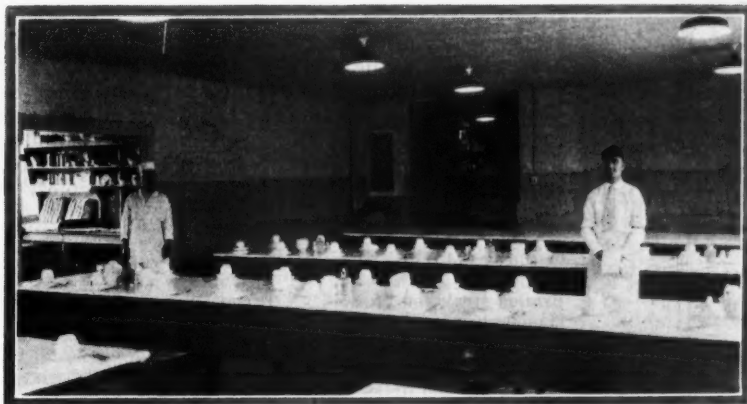
We recruit our maintenance of way forces locally, when possible. Otherwise we secure them from our labor office in Chicago. Our floating or extra gang

of from three to five hours in the delivery of the men.

Our floating or extra gangs on the Joliet division are housed principally in coaches, fitted up for this purpose. They afford better light and ventilation than box cars and are much easier to keep clean. Our housing quarters for our main line section labor consist of a standard section labor house and car bodies comfortably arranged and set on the ground. One of the drawings shows the plan of the standard section labor house, which will replace the car bodies in use at present as the occasion demands.

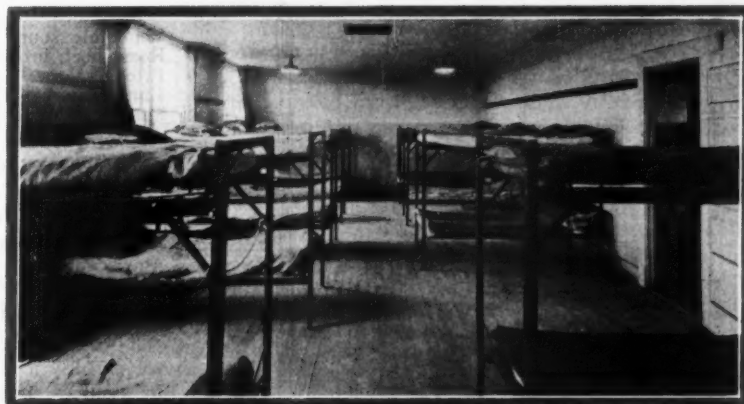
*A paper presented before the Maintenance of Way Club of Chicago on November 16.

The track labor camp of the Elgin, Joliet & Eastern at South Chicago is an outstanding example of substantial construction designed to insure a maximum of comfort for the men and to facilitate the observance of effective sanitary rules. It is 150 ft. long by 42 ft. wide with brick exterior walls faced on the inside with fireproof tile, all interior partitions being of tile throughout.

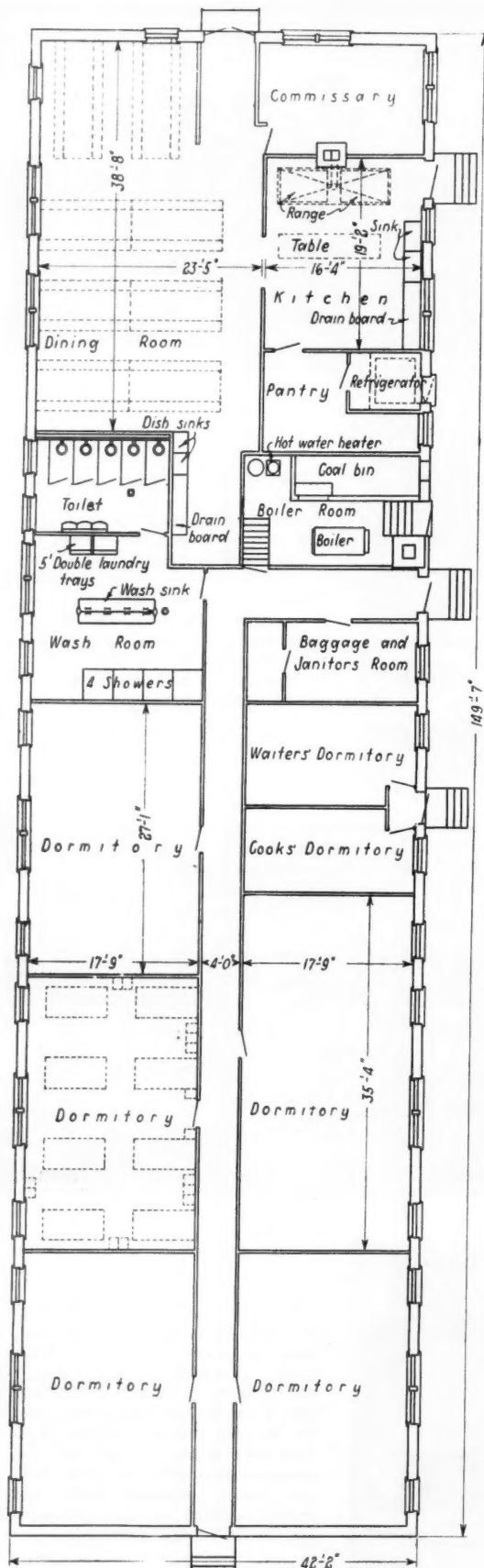


The kitchen, dining room and commissary store are separated entirely from the dormitory section of the building, there being no communicating doors. This places the boarding and commissary departments entirely under the control of the contractor, the Omaha Boarding and Supply Company, who can therefore be held strictly responsible for proper maintenance and thorough cleanliness.

The dormitories afford ample light and air for the occupants, who also enjoy the comforts of steam heat during the winter season. The ventilated air space between the curved roof and the ceiling serves to keep the room cool in the summer. Well appointed toilet facilities which afford opportunities for washing, bathing and the laundering of clothing foster cleanliness on the part of the men.



Tile walls and a cement floor in the kitchen facilitate the maintenance of a high standard of cleanliness. A metal, air-tight garbage box located outside the building, with a convenient dump door from the kitchen, insures absolute freedom from odors and prevents the propagation of flies. Kitchen utensils, range, working tables and dishes supplied by the contractor are all of a high standard.



Floor Plan of the Labor Camp at South Chicago

The section and extra gang laborers on the Gary division are housed in three stationary dormitories. The arrangement of all three of these buildings is similar. The group of photographs illustrates the interior and exterior of the one located at South Chicago. The dining room and sleeping rooms will accommodate 90 men. The sleeping quarters are divided into rooms, each of which is equipped with eight double-deck beds, this number being based on a study of the available floor area, cubical contents and window space. A 12-in. ceiling ventilator is provided in the center of each room. All doors and windows are screened. The windows in the sleeping rooms are provided with shades, which, when drawn, darken the room, thereby permitting the men to enjoy undisturbed rest between the hours of four and six a. m. during the summer months. Other facilities include well lighted and ventilated kitchens, storerooms, shower baths and washrooms with standard cement wash tubs. Hot and cold water, steam heat and electric light are also provided.

The food in our labor dormitories is furnished by a boarding contractor and the men pay \$1.05 per day for room and board. The meats and other supplies for their use are shipped fresh from Chicago three times a week. The following menus are typical of the meals served.

Breakfast

Oatmeal and milk	Buckwheat cakes and syrup
Corn flakes and milk	Strawberry jam
Broiled steak and gravy	Bread, butter, coffee
Hashed brown potatoes	

Dinner

Cream of tomato soup	Fried sweet potatoes
Roast pork and dressing	Home made pumpkin pie
Mashed potatoes	Bread, butter, coffee
String beans	

Supper

Vegetable soup	Prune sauce
Roast beef, brown gravy	Chocolate cake
Fried potatoes	Hot biscuits
Lima beans	Tea, coffee
Stewed tomatoes	

Owing to the distances which the men are required to walk to and from work, the track men on the Gary division carry their lunches in dinner pails. This lunch consists of the following articles of food:

Roast beef sandwich	Sliced onions
American cheese sandwich	Pie, cake, coffee
Veal loaf sandwich	

Watch Conditions of Quarters

To insure cleanliness and order in our dormitories we employ a man at each place to keep the building in a clean, neat and sanitary condition. The bedroom windows are opened for a period of four hours each morning and the rooms are thoroughly aired (they are disinfected daily) closed later in the day, and made comfortable for the men upon their return from work. Each dormitory is inspected frequently by the roadmaster and myself and in this way we know personally that they are kept in proper condition.

We have also provided very comfortable living quarters for certain of our transportation, mechanical and other department employees at Gary, Ind., and at Rossville, Ill., Joliet and Waukegan. We maintain an enginemen's dormitory, a restaurant and hotel at Gary and an enginemen's dormitory at Waukegan. The restaurant is capable of furnishing 800 meals daily with 24-hour service. Full meals can be had here at more reasonable rates than elsewhere. Our hotel has a capacity of 90 men and is equipped with a restaurant.

One of the photos shows a section foreman's house at Lake Zurich, Ill. This house, as well as many others of its type, afford our section foremen comfortable living quarters. This one is known as the "Home of a Thousand Flowers," having flower beds containing 30 different varieties.

The living habits of Mexican laborers and their families when they come to this country, are such as to manifest a total disregard for cleanliness and sanitation. Shortly after the war we were required to recruit Mexicans for our section work and upon inspection of their living quarters we discovered some very insanitary conditions. We tried several schemes in an effort at improvement, but to no avail. Finally a plan was put into effect under which the section foreman is required to go into each house under his jurisdiction on Wednesday and Saturday of each week for the purpose of teaching these people how to scrub the floors and to keep their quarters in a clean and tidy condition. Failure on their part to carry out these instructions results in their dismissal. The foremen are also required to make reports of the conditions they find to the chief engineer. The roadmasters are required also to inspect all such houses on their districts once each month and make similar reports to the chief engineer. I accompany the roadmasters on all such inspection trips and report my findings directly to our vice-president. The first few inspection trips were anything but encouraging, but we could detect some signs of improvement here and there. Later on, however, every house of this nature on our railway, with the exception of one, was found to be remarkably clean, which convinced us that Mexicans can be taught our standards of living. These improved living conditions were obtained as a result of education over a period of 10 months.

Helping the Mexican

The Mexicans are willing and will learn very readily. They are not solely to blame for their lack of knowledge of proper living habits. I have been told by some of them that the people of their country had made no attempt whatever to teach them how to live. Our European and American section laborers have left the railroads and entered the industrial and other fields of labor, so that the Mexicans have become a necessity on the railroads of this country. If this is true, why not start now and teach them the American standard of living, so that they will make more desirable citizens?

The management of the Elgin, Joliet & Eastern is now seriously considering the employment of a matron to teach the Mexican men and women how to use and prepare food which is more nourishing and suitable in the North than the inadequate diet on which they now try to live. I recently watched one of our Mexicans eating a lunch which had been prepared at home. It consisted of four tortillas, a sort of pancake made of flour, salt and water. Surely such food has insufficient nourishment for a man engaged in track work.

Remarks made to me many times by this and other classes of employees lead me to believe that our men generally feel that the management has a personal interest in their welfare. This makes for contented employees, and an employee who is thoroughly contented with his position is one of the greatest assets a railroad can have. It is of course difficult to establish his value in figures. It is intangible but it is there nevertheless. Our treatment of our employees, our housing conditions, the im-

provements made from time to time, the sanitary conditions of these places, our food service, our drinking water regulations and supply, the establishment of lawns and flower beds about our laborers' living quarters, our constant inspection and supervision of these facilities in general, have aided in bringing about the contentment to which I have referred. Obviously, we do not claim to have completely solved the housing problem of the railroads, but we do feel that our employees and our company have benefited greatly as a result of our efforts to bring about an improvement in this direction.

Annual Track Inspection on Southern Pacific Lines

THE Southern Pacific Lines in Texas and Louisiana has issued a booklet of 124 pages, tabulating the results of the annual inspection of tracks, roadway and structures which was made in November and December and which covered 4,547 miles of road. The El Paso division received the highest division rating for the eighth consecutive time and it is interesting to note that its score in each of those years was higher than in the preceding year. The territory of P. P. Marion, roadmaster of the El Paso district of that division, was given the highest ranking among the roadmasters, while the track of S. Shaw, Jr., of the Del Rio district of the same division, received the highest score among the section foremen. Following the usual custom, cash prizes of \$100 were awarded the foreman having the best section on each district of the system, with prizes of \$75 and \$50 for the foremen of the second and third best sections, respectively, on each district. On six districts, two foremen were tied for first place, while on the Jacksonville district of the Beaumont division a triple tie for first place resulted.

Views of various prize winning sections are shown in the booklet, with the foreman of the section appearing in the picture. The booklet is also illustrated with views of various structures, station grounds and other facilities which indicate the emphasis which the road places on neat and attractive maintenance. A list of "perfect" facilities of this nature includes 344 section houses, 286 stations, 72 pump houses, 26 fuel oil stations, 38 shops and engine houses, 31 signal towers and 62 signal headquarters and 66 miscellaneous structures, the name of the person in charge of the facility being shown in each case.



New Double Track Line on the Missouri Pacific East of Jefferson City, Mo. Old Line on the Right



"Well, the quicker you can get them off the right-of-way, the better it will suit me."

Do the Railroads Expect Too Much of the Manufacturer?

Supply Men Air Their Views on the Use and Abuse of the Service Department

"DO YOU want to know what I think of your machines?" said the general manager of a prominent railway to the salesman. "Well, the quicker you can get them off the right-of-way, the better it will suit me. They're no earthly good; we can't keep them running. Yes, you can go out to see them if you want to, they're on a section about 50 miles west of here, but it won't do you any good; they don't work, that's all."

This was not encouraging, nor was the matter simplified by a visit to the section foreman, an intelligent young fellow, who was clearly doing his best to keep the machines running. Furthermore, a careful check of the equipment disclosed no defects that would explain why the gasoline power unit would run only a few minutes, after being started, then begin to show signs of weakness, gradually slow down and finally stop altogether. The salesman was about ready to admit defeat, when he noticed a tomato can about half full of dirty black oil.

"What's this?" he asked the foreman.

"Oh, that's some hand-car oil that I mix with the gasoline, I thought we ought to use some, but I didn't know how much. Guess I've used plenty, though."

"Have you any clear gasoline on the job?"

"Yes, about four gallons."

"Well, let's drain off all but about a quarter of the stuff that's in the fuel tank now and fill it up again with clear gas. We'll also clean out the carburetor too and then see what happens."

This did the trick, the engine started and worked without interruption until quitting time, a fact that

was duly reported to the general manager next day.

"Please don't get the idea," explained the salesman, "that I am blaming the foreman, it was not his fault. He had never seen any of our machines before. They were shipped to him from another division and he was told to use them. He received no instructions whatever, either verbal or written. Apparently the instructions which we sent out with the machines were lost, but you know we keep a supply of these on hand in our office and will gladly supply additional sets at any time."

This incident was recounted by an officer of a well-known supply company when he was asked to explain the reason for maintaining a service department. His answer opened a new channel of thought and led to similar inquiries of other manufacturers, not only with respect to the need for such service, but also its practical application. Do the railways generally take advantage of it, do they abuse the privilege of such service, why is it necessary, were some of the questions asked.

Service Is Important

"We are glad to give this service," said the vice-president of another company, "because we realize that the introduction of new devices and equipment gives rise to many problems for the railway organizations. Their men, particularly in the track department, are not expert mechanics and cannot be expected to be. They are not accustomed to the use of power tools. When we organized our company, we made up our minds that we would not stint in our appropriations for such service, and I am con-

vinced that much of our success is due to the fact that we have always gladly sent our men hundreds of miles in answer to a complaint."

"The primary reason why we are anxious to render all reasonable service," said one supply man, "is to make sure that our machines get a fair trial. We know that more than one of them has been discarded as useless because the man to whom it was assigned received no instructions or would not take the trouble to read the instructions furnished him. Our machines have now been in service for so many years, that there is sure to be at least one hobo in every extra gang who has worked with them and can run one if given a chance. But even at this late date we occasionally encounter cases where men will not take the trouble to learn how to use them."

"This difficulty does not usually occur when a new lot of our machines is delivered, because we make it a point to have a man on the ground when they are tried out to see that the men are thoroughly instructed in their use. The real trouble starts when the machines are loaded up and sent to another division where the men are expected to use them with no instructions whatever."

Need of a Maintenance Organization

One reason given by a number of the supply men interviewed for maintaining a corps of service men, is the failure of many of the railroads to provide an adequate organization for the care of the labor saving equipment they buy. This point was brought out clearly by an officer of one of the manufacturers.

"It is not necessary for the operator of a labor saving tool to be a mechanic, any more than it is for the driver of an automobile but where would the automobile industry be today if there were no garages where the car owner could have his auto overhauled when it needs attention? It is the same with appliances used in railway maintenance. Regardless of the fact that the tool is so simple that one can learn to run it in an hour's time, it should be in the care of some one with sufficient mechanical skill to see that it is kept in working order. Furthermore, these maintenance men should be subject to some sort of centralized control to insure that there is a reasonable degree of supervision of their work."

"We have been seriously concerned with this matter, in connection with a new piece of equipment that we put on the market a year or two ago. We have gone so far in some cases as to take the position that we do not care to furnish our new machines unless we are assured that the railroad will arrange for an organized plan which will make some one man definitely responsible for the proper care of them."

Unnecessary Calls for Service

The maintenance of service organizations by the manufacturers is a source of large expense which is necessarily reflected in the price of the equipment they sell. But, as pointed out by nearly all of the men interviewed, their service expenditures are larger than necessary because of the many emergency calls they receive, which upon investigation, are found to originate in some minor difficulty that should have been overcome by the man on the ground.

"I recently traveled 200 miles," said a service man of a large manufacturer of electrical equipment, "to run down a hurry call for help, only to find that the trouble was a broken wire caused by a kink in a conductor cable. I cut off the cable and spliced it in

less than five minutes. In another case it was a burned out fuse, and in still another, a bad spark plug."

Another service man reported a five-day trip for the purpose of running down a trouble call that was brought about by a small wad of lint in the gasoline line.

Motor cars are now in such general use that the manufacturer is rarely called upon to render emergency service for other than bona fide defects. But even now their operation occasionally leads to service demands that are not justified.

"I ran across one of these the other day," explained the vice-president of one of the motor car companies. "A roadmaster reported that the engine of his car vibrated to such an extent that he had to give up riding it. When our service man looked the car over, he found it was about ready to fall apart. Every bolt in the frame was loose. Ten minutes work with a wrench eliminated all of the 'excessive vibration' of which the roadmaster had complained."

"At the time of the first heavy freeze each fall, we get a flock of calls for help on account of engines frozen up," is the report of another service man. "This all results because someone has neglected to send out a warning against that very thing."

A specific illustration was related by a railroad officer concerning four cars that were shipped out to a rail gang early in the spring, after they had been in storage all winter. They were tested out at the storage yard and loaded without draining the cooling system. They froze in transit.

Read the Printed Instructions

The value of following printed instructions was stressed by the service man in the employ of a manufacturer of air compressors.

"Too often," he said, "a man has failed to follow simple rules for trouble shooting. Instead of checking the spark plugs, fuel lines and wiring, he will attempt to adjust the timer or some other part that has adjustments without reading instructions, with the result that he will have the machine entirely out of adjustment before he gets through."

"Other troubles arise from plain ignorance. We once got an awful scare because the cylinders of a large and expensive engine were reported to be full of water. It looked like a case of a broken cylinder block, so I drained the engine, refilled the cooling system and watched the machine for several days, to see if the water would again accumulate in the cylinder. Finally the truth came out. Some fool was told to fill the radiator and instead he poured water in the muffler."

"Carelessness also causes a lot of unnecessary trouble. We were advised by a certain railroad that its men were unable to start one of our compressors that was being used temporarily to run an interlocking plant. They had found it impossible to turn the engine over, although they had worked at it for two days. When I got there, I took the head off, and I found that the pistons were rusted tight in the cylinders. The machine had been put into storage without taking the trouble to put in some oil or kerosene."

Calls for help from the service man are not infrequently the result of thoughtless abuse of the equipment, primarily overloading. Motor car manufacturers are probably confronted with this condition more often than any other railway supply companies. Men will insist on loading light inspection cars as if they were heavy-duty section cars.

"We have also had experience with overloading," said the representative of a well known company, "Some of the railroads are using equipment for handling rails that we built when 90-lb. rail was as heavy as was used on other than a few of the eastern roads. But they are now trying to handle 130-lb. rail with the same machines."

In some cases the service man finds that the trouble is due to an attempt to use worn out tools. Reduced output of tamping machines, for example, has been found to result from the fact that the faces of the bars had been worn down to almost a chisel edge through long use in very hard rock ballast. Poor performance of machines is sometimes explained by the fact that they have clearly reached the end of their service life, imposing on the representative of the manufacturer the necessity of suggesting as tactfully as possible that they be retired and replaced by new equipment.

There have also been cases where the supply man has made a long journey, only to find that his presence is desired for no other reason than to act as an intermediary between the man on the job and his superior officers. Perhaps the foreman or the supervisor has been criticized for a low output of work when he knows that the fault lies in worn out tools. After repeated requests for replacements without avail, he wires the manufacturer, and when the representative arrives he asks him to intercede in his behalf.

Makeshift Repairs

"Makeshift repairs are another source of unsatisfactory service," said the representative of one supply company. "When a breakdown occurs it is important to get the machine back in service as quickly as possible in order to avoid loss of time of a gang and to carry on the work according to schedule. For this reason, we are glad to see a man make any sort of a patch repair job in order to get the machine working again. But such makeshifts are good only for a short time. They are bound to give trouble sooner or later. What he should do, is to order the necessary repair parts at once, and when they come he should install them without delay. Too often if the machine is working in good shape when the repair parts come, there is a tendency to 'leave well enough alone,' with the result that the repair parts are laid aside and not thought of again until the temporary repair part gives out."

"I can usually tell what kind of care our machinery has had, by the way it looks when I visit any job where it is in use. If it has been kept clean, if all bolts are tight, and if units not in use are being protected from the weather, I can feel reasonably sure that it has received pretty good care. It is surprising how many men there are in charge of track appliances who never think of cleaning a machine or of taking it apart to flush the working parts with kerosene for the purpose of washing out the accumulations of grit."

Most Calls for Help Are Legitimate

While nearly all of those interviewed were able to cite several cases of unnecessary calls for help from their service men, they were agreed that service is an essential to the successful introduction of mechanical equipment. They also freely admitted that most of the calls are of an entirely legitimate nature and not due to the fault of the user.

"It is through these service visits of our men,"

said the president of one company, "that we learn of ways to improve our devices. If we notice that a certain casting is subject to breakage in more than a very few cases, we conclude that it should be strengthened. There is another point that I am constantly impressing on our service men, namely, that they must not expect everyone to understand our machines as well as we do ourselves. Some difficulty which may seem ever so simple to us may puzzle some other man a great deal."

"Don't get the impression that I think that service on the part of the manufacturer is being overdone. Instead I think that it has been a vital factor in the extension of the use of labor-saving machinery on the railroads. However, it does seem to me that certain of the railroads would get a great deal more out of their equipment if they would supplement the service rendered by the manufacturer with a greater degree of supervision on the part of members of their own organization."

N. Y. C. Distributes Prize Money to Foremen

IN making the 1927 track inspection and prize awards the New York Central (Buffalo and East) again followed its individual plan, devised several years ago, of dividing its track into classifications, and then sub-dividing the classifications into groups, each group within each classification containing only sections similar in character. During the 1927 inspection, which was made with a special inspection train, the final rating for each track section was determined from the markings of separate groups of inspectors assigned to the rating of alignment, surfaces, and neatness and drainage.

The awards made to the winners are in the form of premiums added to their regular compensation. Following this plan, the foremen who receive the highest ratings in their respective groups are awarded monthly premiums of \$5 throughout the year. Similarly the foremen receiving the highest ratings in each classification are awarded an additional premium of from \$2 to \$3 a month. In addition to these specific prizes, \$10 gold pieces are given to the foremen who have received the highest marks in their respective groups for four or more consecutive years.

As a result of the 1927 inspection, the classification prizes were awarded to the following foremen:

- Classification 1, John Andros, sub-division 3, Eastern division.
- Classification 2, E. Teats, sub-division 27, Pennsylvania division.
- Classification 3, C. Laverghetta, sub-division 18, St. Lawrence division.
- Classification 4, C. Crippen, sub-division 24, Pennsylvania division.
- Classification 5, J. Crzybeck, sub-division 13, Buffalo division.

The highest average rating of any sub-division was 85.5, this being given to Subdivision 10 of the Syracuse division, W. N. Skelton, supervisor. The second and third highest ratings were 85.3 and 85.0, which were given respectively to Subdivision 13 of the Buffalo division, T. W. Sexton, supervisor, and to Subdivision 13-B of the Buffalo division, J. P. Sexton, supervisor. The highest division rating was awarded to the Buffalo division, which was given a grade of 85.2, while the second highest division rating was given to the Eastern division, with a grade of 83.5. The general average rating for the lines, Buffalo and East, was 83.2, as compared with the average rating of 83.0 established in 1926.

Many Power Tools for Bridge Work

Gasoline Engine and Electric Driven Devices Compete with
Steam and Pneumatic Equipment in This Field

By G. A. HAGGANDER
Bridge Engineer, Chicago, Burlington & Quincy

THE USE of labor saving devices in bridge work is increasing rapidly, and while no road is probably using them to the fullest extent, taken as a whole, there are many machines which are being used with economy on various roads. A study of the equipment in use and the service they render has led to the following account of the most advanced practice in the use of labor saving devices in bridge work.

On pile bridge work all pile driving should be done

machines extensively for handling timber, employing them for this work during the time when they are not actually used on rail laying. By doing most of our pile trestle bridge work in the winter time, the maximum use can be obtained from this class of equipment.

To assist in the framing of timber bridges it is economical to use power equipment for boring and sawing. We have used air compressors to some extent on large jobs for operating wood-boring machines. However, a new development in electric cross-cut saws has made it advisable to provide electric generator sets for timber bridge work. One of the new power cross-cut saws will cut off a bent of six piles in 8 min., whereas the same work done by hand will take two men $1\frac{1}{4}$ hr.

Electric Tools for Framing Bridge Timbers

Electric power can also be used to operate wood-boring machines, small portable circular saws cutting to a maximum depth of four inches and electric wrenches for putting in lag screws. These electric generator sets, with the saw and boring equipment, are especially useful on emergency work such as washouts and burnouts where they not only expedite the sawing and boring but also furnish illumination. The rail-laying machines may be equipped with air compressors or electric generators, thus concentrating in one unit all machinery needed for handling timber, boring and sawing it. Machines are also available for dapping ties or fenders where this is standard practice. If a pile trestle bridge job is equipped with a self-propelling, high-speed pile driver, and the



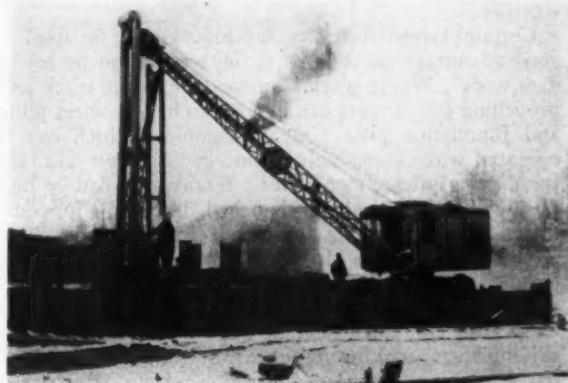
Self-Propelled Pile Drivers Need No Work Train

with high-speed, self-propelling pile drivers. These drivers should have a speed of 15 miles per hour and should be capable of hauling one or two carloads of material at a time to reduce the cost of unloading. On roads using fuel oil the use of oil-burning equipment is advisable, as the expense of a fireman can thus be dispensed with. These self-propelling pile drivers should, of course, be equipped with steam hammers, although a drop hammer should be carried for emergency use. Experience shows that slow propelling speeds greatly restrict the work of a pile driver because of the time lost in running to and from bridges. This sometimes makes it necessary to use a work-train in spite of the self-propelling feature. In order to get the maximum use of the pile drivers it has been found advisable to use them almost entirely for driving piles, rather than to keep them on any one job for handling timber, etc., until the work is completed. When pile drivers are not otherwise employed it is of course advisable to use them in this way.

The Pile Driver Should Have a Tender

Where a supply of coal and water is not readily available pile drivers should be equipped with two tenders. In territory where piles must be jettied occasionally, a jet pump should be a part of the regular pile driver equipment.

On large timber pile trestle jobs we are effecting considerable savings by the use of a light clamshell derrick. We are also using self-propelling rail-laying



Cranes Are Easily Converted Into Pile Drivers

timber is handled with a light derrick or rail layer and the sawing and boring is done with electric tools, the work will be done with maximum economy.

Holes bored in creosoted lumber should be treated with creosote to protect the untreated wood thus exposed to decay. We have been experimenting with the use of a small automobile oil gun for this purpose and find that the exposed wood in a horizontal hole can be

treated effectively by plugging one end of the hole, and forcing it full of creosote with the gun, which is used also to withdraw the surplus oil. This is superior to the old method of applying the creosote through a bent funnel or with a swab.

Self-Propelled Cranes for Bridge Erection

On steel erection jobs self-propelling derricks are also most economical. The tendency in this field is also toward high-speed equipment. Air compressors are necessary for this class of work for drilling and reaming holes, cutting, bucking up, driving rivets, etc. Wood boring machines can be used for drilling holes in the falsework. Rivet busters will be found economical on most work as one-man busters or heavier machines are available for various classes of work. It is also advisable to have an acetylene burner in a steel-erection outfit as it can be used conveniently and economically for many purposes.

When constructing overhead highway bridges or doing work away from the track, gasoline-driven hoisting engines will be found economical as they are not as bulky as steam hoisting engines and do not require coal



Rail Crane Handling Pier Excavation

or water, which are sometimes difficult to supply. Neither do they require any preparatory time before being put into service or attendance at night during cold weather.

Certain types of heavy machinery can be used to good advantage on jobs requiring excavation or cofferdam work. Where work is under an existing track self-propelling pile drivers can be used to handle sheet piling and foundation piles. Steam hammers which can be operated when completely submerged are now available for driving piles under water. Excavation can be handled with self-propelling clamshell derricks. Jobs at a distance from existing tracks are handled most effectively with gasoline-driven machines having crawler treads. A caterpillar machine, which may be used for either dragline or clamshell work, can be employed for excavating the pier site, setting up sheet piling and driving them, making the excavation and driving foundation piling. They are much more elastic than stiffleg derricks. Sheet piles for cofferdams can be driven with hammers operated by either steam or air. Air is preferable and sometimes necessary in certain types of deep open caissons. These hammers are made in various sizes to suit conditions.

For pumping on small jobs, the gasoline trench pump has been found useful, while on larger jobs, gasoline-driven centrifugal pumps are often thought to be superior to steam-driven centrifugal pumps, syphons, etc.

Gasoline and steam driven concrete mixers have been

used generally for so long a period, as have various types of hoists, chutes, buggies, etc., for depositing concrete, that their use is well established. On concrete jobs where there is considerable form work, a gasoline-operated table saw can be used to advantage. These are also used by building gangs. One of these saws should be installed for miscellaneous work in a carpenter shop at division headquarters where no woodworking shop is accessible.

The placing of culvert pipe under all except low fills can be done economically with a clamshell derrick. This should have a high propelling speed and can be used for excavating, handling pipe and backfilling. For low fills the track can be supported on special rail girders to avoid expensive falsework or blocking. These consist of heavy rails laid on each side of the running rail, the latter being supported on the two girder rails by means of short transverse beams suspended from them by hangers.

Culvert Pipe May Be Jacked Through Fills

For high fills where the cost of falsework and excavation is excessive it is practical to jack corrugated iron pipe culverts through the dump rather than to construct a tunnel. Excavation is carried on as the pipe is jacked forward. The track is not disturbed by this method of construction.

Compressed air tools are a means of saving labor for miscellaneous work, such as sandblasting, painting, breaking concrete, cement gun work, hoisting, driving sheet piles, etc. For cleaning badly rusted steel pneumatic chipping hammers and rotating wire brushes can sometimes be used as well as the sandblast. Concrete breakers have been developed rapidly and are invaluable for this class of work. On mass concrete it may be found necessary to drill and shoot it to some extent and to complete the wrecking with the concrete breakers.

Small tools which should be a part of the equipment of every gang are rail dollies, ratchet wrenches, tool grinders and stocks and dies for rethreading bolts and pipe. Rail dollies or track barrows can be used to handle rails, ties, timber, cement and other heavy materials. They can be operated by one or two men and can be removed from the track quickly, they are therefore safer to operate than a rubble car. Another piece of equipment which should be furnished every division bridge and building gang is a small inspection motor car for the use of the foreman in making his bridge inspection, or for carrying one or two men over the road doing miscellaneous work without taking the gang motor car away. The use of motor cars to transport men is now considered a necessity and this car should be of sufficient capacity and of such construction as to allow it to be used for transporting material from one job to another or from a siding to a job.

Co-operation Between Departments Is Essential

The successful use of some of the labor saving devices mentioned above on bridge work depends largely on the degree of co-operation between the various operating and maintenance forces. Those in charge of the work must be familiar with the most economical way of handling it and have proper equipment assigned to it. To receive full value from an investment in such machinery as clamshell derricks, rail layers, air compressors, electric generator sets or dragline excavators, they should be used continuously, except for the time needed for overhauling them. To accomplish this, the bridge work that can be handled economically with these machines, should be scheduled so that it may be done at times when they are not needed on other work.

Southern Pacific Eradicates Weeds

An Account of the Methods Employed in the Use of Various Chemicals During the Past Ten Years

THE eradication of weeds by chemical processes was first undertaken on a large scale by the Southern Pacific (Pacific Lines) in 1917. This work was performed by contract, and was continued on that basis in 1918 and 1919. Prior to that time, it had been the usual custom to clean the grass and weeds from the track and roadbed by cutting, which was done by the section forces. At various times the company had also used a weed burner.

In 1920 there was placed in operation a specially constructed chemical train which was built in the company's shops and which is operated by its own forces. This train applies a poisonous chemical with an arsenic and caustic content to the track through a sprinkler by means of air pressure. A second train was built later to permit spraying the tracks on the entire system just after the spring rains and before

which is also known as "still-bottoms," has been used with success. This material is obtained from the oil refineries and greatly retards the growth of these particular grasses. During the past three years a considerable amount of slop distillate has been used on tracks through station reservations, particularly on common varieties of tender weeds, with good results. A by-product of the company's Pintsch gas manufacturing plant, known as "Tarkill," has also been used on salt, Bermuda, and Johnson grasses with good results.

Sodium Arsenite the Best

Summing up the results obtained by these various weed killers, it can be said that the best general results are obtained by the use of the poisonous sodium arsenite chemical, although "still-bottoms"



Photograph Taken October, 1927, Showing the Clean Condition of Track Near Redwood City, Cal., Sprinkled Early in Each Year with a Chemical Weed Killing Solution

the weed growths become rank. For general work the poisonous sodium arsenite chemical has been used since 1917, with exceptionally good results.

Use a Non-Poisonous Weed Killer

This year the company also used a non-poisonous weed killer having a sodium chloride content on about eight per cent of its applications. This chemical was used in order to eliminate stock losses where spraying is necessary through station grounds and on portions of the right-of-way not protected by fences. This non-poisonous chemical has shown fair results thus far, but further experimentation will be necessary before its effectiveness can be stated definitely.

Rock salt applications have been made on horsetail, morning glory, and salt grass, and have given a temporary surface growth kill or retarded the growth for a short period of time. The effectiveness of rock salt application is short-lived, however, and does not warrant its extensive use.

In order to eradicate Johnson grass, Bermuda grass, salt grass, and horsetail, which are affected only slightly by the sodium arsenite, slop distillate

are very effective. The caustic soda in the sodium arsenite chemical kills the surface growth effectively and the continued penetration of arsenic into the soil for several years sterilizes it to such an extent that the necessity for further yearly applications is greatly reduced.

Chemical train No. 1, the first constructed, consists of a spray car, four solution cars, two chemical cars and a locomotive. The train, when applying the solution, is operated with the spray car in the lead, giving the operators a clear view of the track and roadbed. The locomotive in the rear, pushing the entire train, is equipped with two air pumps so connected as to supply sufficient air. These pumps supply pressure to the train line and to the chemical and solution cars as required. The second pump was installed when the train was fitted up and this particular locomotive is therefore always used on the train wherever it goes. The spray car is a steel underframe flat car on which a house has been erected to shelter operators, and to provide for the safe-keeping of miscellaneous equipment and spare parts.

The solution cars are 12,400 gal. capacity tank cars,

tested to 60-lb. pressure. The domes are sealed tightly and an opening the size of the largest water tank spout or water column has been provided, half way between the dome and the end of the tank, for loading the water. This opening is covered with a heavy steel plate which is held air-tight with stud bolts when the car is under air pressure.

Employ Air Pressure

The air pressure is applied to each of the tank cars through a one-inch pipe running from the main air reservoir of the locomotive to the spray car at the head of the train. Here it is regulated by means of a gage and valve, and then returns to the tank cars, which it enters at the dome through the standard one-inch steam inlet opening. The pipe is carried down into the individual tank cars in a one-inch perforated line which extends for the full length along the bottom of the tank, thus continually agitating

form the solution used is governed by local conditions. It is calculated to apply as much solution as the roadbed will absorb so that the chemical will be evenly distributed and will soak down as far as possible to the roots of the vegetation. The amount of vegetation present and the amount of moisture in the ground affect the possible ratio and these points are considered and the mixture varied accordingly. The sodium arsenite solution used by the Southern Pacific ordinarily varies from between 15 and 20 parts of water to 1 of the chemical; the non-poisonous solution is generally used with 12 parts of water to 1 of chemical. There should be at least 48 hours sunshine or fair weather after any storm to permit the surface of the ground to dry before applying the solution.

The train, when spraying, maintains a speed of approximately 15 miles per hour, applying from 100 to 150 gal. of the concentrated chemical per mile,



Photograph Taken in October, 1927, of Tracks Near Stege, Cal., Showing the Complete Eradication of Weeds by Annual Spraying Application of Chemical Weed Killing Solution

the solution. In order to have a quick method of releasing the pressure on the tank cars, so that covers over water openings can be removed promptly, a two-inch bleeder valve is inserted in the chemical line close to the dome.

The chemical is supplied to each solution tank car through the dome by means of a two-inch pipe running from the chemical cars to the solution cars. This pipe is connected between the cars with a two-inch rubber water hose. The solution is carried to the sprinklers on the spray car at the head of the train by means of a six-inch pipe, with rubber hose connections between the cars. This six-inch pipe is connected to and fed through the regular four-inch outlet pipes underneath the cars in such a way that the poisonous chemical can be shut off from the sprinklers and the non-poisonous material used when passing through station grounds or road crossings, without stopping the train. The solution is applied to the track and roadbed through a center and outside sections of four-inch sprinkler pipes, each of which is controlled by a quick-action valve. The center sprinkler is perforated on the bottom with four rows of $\frac{1}{8}$ -in. holes, spaced 10 holes per foot per row, and covers that portion of the roadbed between the ends of the ties. The outside sprinkler is equipped with swing pipes extending from the ends of the ties out over the toe path to the shoulder of the banks. These swing arms can be raised or lowered and are perforated similarly to the center sprinkler.

The proportion of chemical mixed with water to

according to local conditions. The poisonous solution is shut off 100 ft. from crossings and unfenced right-of-way, and the non-poisonous solution put through the sprinkler over these places. This is done to prevent injury to live stock by poisoning. Placards are posted at crossings and other promiscuous places, notifying the public of the danger to live stock in coming in contact with the vegetation which has been sprayed with the poison.

Train No. 2 Uses Any Locomotive

The second chemical train differs from train No. 1 in that it has five solution tank cars and operates with any type of locomotive furnished. The pressure is obtained through a connection to the steam dome of the locomotive. A steam line extending the length of the train carries the steam to the spray car in which are installed steam pumps, furnishing pressure to the tank cars.

The slop distillate, or "still-bottoms," is not diluted and is applied by merely attaching spray pipes to the unloading pipe of the tank car, the liquid flowing by gravity while the train is operating at a speed of from six to ten miles per hour, with a distribution of from 1,700 to 2,400 gal. per mile, according to the amount of vegetation present. The by-product "Tar-kill" from the company's Pintsch gas plant is applied in the same manner as the slop distillate.

We are indebted to W. H. Kirkbridge, engineer of maintenance of way and structures of the Pacific Lines of the Southern Pacific, for the foregoing information.



Labor Saving Equipment Aided the Lehigh Valley in Cutting Its Labor One-Third in the Last Ten Years

How About the Section Gangs?

To What Extent Is It Advisable to Supply These Forces with Labor Saving Equipment?

By G. A. PHILLIPS

Engineer Maintenance of Way, Lehigh Valley, Bethlehem, Pa.

IT HAS become necessary for the railroads to assume many additional burdens in recent years, such as the abolition of grade crossings and the installation of train control. Furthermore, traffic has become highly competitive, both passenger and freight, requiring many improvements. The railways must finance these items and it is, therefore, very necessary for their officers to scrutinize expenditures carefully, not after they have passed "over the dam" but in sufficient time to assure themselves that economical practices are being followed. This can only be done by careful planning by each department head. By careful planning I do not mean the economical operation of a department from a financial standpoint alone, but the combined efficiency of low costs and a well maintained railroad as pertains to maintenance of way work.

It is a simple matter to reduce forces but not so easy if sacrifices are not made in maintenance standards. A person must have the courage of his convictions for without this, knowledge is of small value. However, one is only as strong as his organization and it is essential for one to sell them his ideas if he is to be successful.

Should Not Pass Saturation Point

Many economies have been effected on the Lehigh Valley during the last 20 years. Our section gangs have been equipped with most of the labor saving devices in use today and are in a receptive mood for any new developments that mean real savings. To use mechanical devices that do not represent actual savings is, of course, false economy and that brings us to the subject under discussion.

Labor saving equipment should be provided for section forces, consistent with the economies to be made. It is possible, however, to "saturate" a railroad with these devices until one reaches a point where more men are employed in operating the power

tools than would be required to perform the same work without the "so-called" modern machinery. In other words, care must be exercised not to get "top heavy" and *beyond the breaking point* with the use of machinery and not allow enthusiasm to outweigh common sense to the extent of increasing one's costs. New devices are continually being produced and only careful consideration can "weed out" the unimportant. Many machines are purchased by the railroads before they have been fully developed and the roads are paying dearly for the experience of being pioneers in their use. These machines should attain the state of practical and economical perfection before their producers look for customers, and careful scrutiny on the part of the railways will alone correct this.

Men Must Be Trained in Use of Equipment

Labor saving equipment, as a whole, is expensive and must be utilized the maximum number of hours during the year to secure the greatest efficiency and economy. Therefore there is a close relation between first cost, hours of service and savings. It is further obvious that the devices must be kept in operation to keep pace with the interest on investment—which never stops.

Equipment has been sent out to section forces with written instructions to operate it and its movement thereafter directed from the rear of trains. I do not wonder that such roads report adversely on this equipment. Who is to blame? A track supervisor on a railway of medium size recently advised me that he had never seen his engineer maintenance of way although both had been in the service for some time. This indicates an unhealthy condition and in all probability results are not obtained with this kind of an organization. To operate a new machine successfully and economically all concerned must be thoroughly instructed and even then the supervisory officer is not through. It is going to require his most

careful personal attention continually. A careful investigation must be made before tools are purchased and by this I mean actual tests by the men who are going to use them ultimately and effect the economies. Improper and uneconomical tools have been bought and given to section gangs. A trip over the road has disclosed these tools in an obscure corner of the tool house. It was good instruction for the supervisory officer but expensive for the railroad. Again economical and proper tools have been furnished gangs and been found in the same place. This is the section foreman's opportunity to learn and the supervisory officer's mistake in not properly instructing his men before the device was placed in service.

Careful Analysis Should Be Made of Costs

Before supplying labor saving devices to section gangs, an analysis must be made of their operating and maintenance costs, as these items, if overlooked, will, in many cases, provide false economies. A railway equipped with mechanical tools is confronted with the problem of keeping them in repair as they must be in good working condition to produce the maximum number of hours of service. We have found it necessary to establish sufficient small shops and organizations to handle this feature of the work.

However, with the modern developments of today, it is necessary to watch progress carefully to avoid making repairs to obsolete machinery. One has only to compare the first one-cylinder, two-cycle, four-tool air tamping outfit with the present four-cylinder, twelve-tool machine to demonstrate the necessity of careful planning and constant alertness.

Co-operation is one of the most important essentials of any organization and it plays a prominent role in determining how far we can go in providing our forces with labor saving equipment. If a road has labor saving devices and cannot use them on account of traffic conditions, it does not realize on its investment. This is where the transportation department can co-operate by turning over a main line track for a day's rail laying, etc.

In the Interstate Commerce Commission's classification, there are two accounts that require careful examination, namely, Roadway Machines and Small Tools and Supplies. They represent a large item of expense, not only in the money invested but in the expense of maintenance and operation. An analysis of the latter account reveals that gasoline represents a large portion of it, due, of course, to using labor saving devices. Gasoline must be purchased at a minimum price, tank car delivery if possible, and handled properly for security against danger, leakage and pilfering. This same principle applies to many other commodities used on equipment which, as a whole, are the factors that decide how far a road can go in providing labor saving devices.

The Results on One Road

All of the above is general and no definite results are specified. The only way one can get a fair idea of what can be accomplished is to have knowledge of the labor saving tools in use and the reductions made in expenses. The Lehigh Valley is equipped with locomotive cranes, motor cars, pneumatic air tampers, bonding and wood drills, together with many other small power tools. A careful check of our actual labor or payroll expenditures chargeable to expense on all items of maintenance, exclusive of expense charges incident to improvement work, reveals a general decline since 1918 with a minimum

in 1927. In other words, notwithstanding a total increase of \$1,852,124.38 in wages alone during this period, our payroll expenditure on all items of maintenance work, except as above noted, was \$3,856,300.69 in 1927 as compared with \$3,946,452.86 for 1918, resulting in a reduction of man hours from 11,629,549 in 1918 to 7,426,245 in 1927. Labor saving equipment was a great factor in bringing this condition about.

Three More Railroads Announce Prize Awards

SUPPLEMENTING the reports relative to the results of annual track inspections and the announcement of prize awards for seven railroads noticed in the January issue, brief reviews are presented below of the announcements made by the Erie, the Delaware & Hudson and the Hocking Valley, covering the results of annual inspection and the award of prizes on those roads.

Erie Awards \$10,300 in Track Prizes

In accordance with the custom on the Erie, the annual track inspection was made with the assistance of an instrument car which records surface, gage and cross level. Prize awards of \$200 and \$100 were made to the supervisors on each of the Erie's three districts whose subdivisions had the highest and next to the highest ratings, respectively. In addition to these awards, 13 prizes of \$150 were presented to those foremen whose sections received the highest rating on each division, and 47 prizes of \$100 and 34 prizes of \$75 were given to foremen for first and second ratings on individual subdivisions. The total awards to supervisors and foremen amounted to \$10,300. Winners of the supervisors' first and second prizes were as follows:

Division	Amount
New York District, Main Line	
New York—R. M. Cunningham.....	\$200
New York—W. H. Wahl.....	100
New York District, Branch Lines	
N. Y. S. & W.—C. A. Joyce.....	100
Eastern District, Main Line	
Susquehanna—F. Fisk.....	200
Wyoming—F. B. Bisbing.....	100
Eastern District, Branch Lines	
W. B. & E.—M. Hopkins.....	100
Western District, Main Line	
Meadville—A. Bernard.....	200
Mahoning—P. H. Cunningham.....	100

D. & H. Awards Cash Prizes

As a result of the 1927 inspection on the Delaware & Hudson, the Susquehanna division attained the highest rating, or 88.79 per cent, while the highest rating for a roadmaster's territory was given to George Smith of the Champlain division. In making the rating, upon which the awards to the various foremen are based, the tracks are divided into three principal classes, namely, main line, branch lines and yards. The awards include 4 system prizes, 2 main line and 2 branch line; 14 division prizes, 8 main line and 6 branch line; and 4 yard prizes. In addition, 8 prizes were also awarded to the foremen of sections showing the greatest physical improvement during the year.

The grand system main line prize for the year was won by N. Deso, foreman of section No. 8 of the Champlain division, whose track was given a rating of 100 per cent, while the second system main line prize was awarded to L. Delasco, foreman of sec-

tion No. 9 on the Susquehanna division, with a rating of 99.6 per cent. The first and second system branch line prizes were won respectively by H. F. Parker, foreman of section 6 of the Saratoga division, with a rating of 91.1, and J. Battisti, of section 11 of the Champlain division, with a rating of 88.2. In each instance, the first and second system prizes amounted to \$50 and \$25, respectively. These amounts were awarded to the winning foreman in addition to the first and second division prizes which are \$100 and \$50, respectively. The two yard prizes were also \$100 and \$50, while those for the sections showing the greatest improvement were \$50 and \$25.

Hocking Valley Awards 18 Prizes

The thirty-second annual track inspection of the Hocking Valley was held on November 21 and 22, combining a mechanical test with personal scoring by a number of inspectors. Low joints, cross level and gage were recorded by the Erie's inspection car; alignment, policing and general order, ballast and ditches, and ties and crossings were rated by inspectors.

The test car revealed a decrease of 30 per cent in the number of $\frac{3}{8}$ -in. and $\frac{5}{8}$ -in. low joints and an improvement in cross level as compared with the record in 1926. Increased weight was given to the matter of policing

and general order in this inspection, emphasis being laid on the general appearance of the right-of-way. The last year was characterized by a great decrease in low joints, due largely to the fact that the chipped and battered joints on a considerable mileage were built up by oxy-acetylene welding. Improved cross level and surface were obtained largely by the use of pneumatic tie tampers on the heavy traffic division between Columbus and Toledo.

This inspection showed a decided improvement in the general condition of the track, roadbed and appearance of right-of-way over that of 1926 and especially of the ballast. Practically all of the roadbed was dressed to standard ballast section for the first time in many years.

The tabulation of grades of the Inspection committee, combined with results of mechanical test on low joints, etc., resulted in the following awards, based on percentage of improvement over 1926: In the case of supervisors the first prize of \$100 went to E. C. Snouffer, Fostoria, Ohio, District No. 1; the second prize of \$75 to F. A. Sparks, Marion, Ohio, District No. 2; and the third prize of \$50 to L. J. Quinn, Logan, Ohio, District No. 4. In addition to the above five prizes each of \$50, \$25, and \$10 were awarded to foremen whose sections received the first, second and third highest ratings on each of five supervisors districts.

N. R. A. A. to Hold Large Exhibit

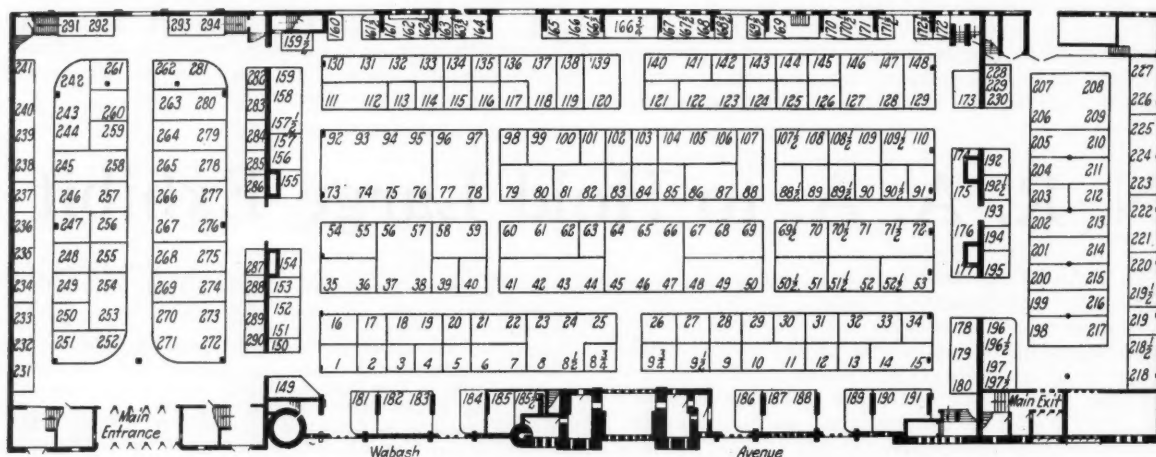
BY CAREFUL study and some minor alterations in the arrangement of booths it has been possible to increase the exhibition area at the Coliseum to accommodate one more firm at the annual exhibit of the National Railway Appliances Association than last year. As in past years this exhibit will be held concurrently with the convention of the American Railway Engineering Association, opening Monday morning, March 5, and closing Thursday afternoon, March 8. The Coliseum will be open to visitors one evening, namely Tuesday, March 6.

The following companies will exhibit at the spaces shown:

AC Spark Plug Company, Flint, Mich.	168½
Adams Motor & Manufacturing Company, Chicago	218-218½
Adams & Westlake Company, Chicago	96-97-77-78
Air Reduction Sales Company, New York	167-167½-168
American Cable Company, New York	102
American Car & Foundry Company, Chicago	259
American Casting Company, Birmingham, Ala.	260
American Chain Company, Inc., Bridgeport, Conn.	81-82
American Fork & Hoe Company, Cleveland, Ohio	235-236
American Hoist & Derrick Company, St. Paul, Minn.	88½
American Railway Hydrant & Valve Company, Stapleton, S. I., N. Y.	160
American Steel & Wire Company, Chicago	265-278
American Valve & Meter Company, Cincinnati, Ohio	130-131-132-133
Ames Shovel & Tool Company, Boston, Mass.	83½
Anchor Company, Milwaukee, Wis.	163½-164
Armco Culvert Manufacturers' Association, Middletown, Ohio	99-100
Associated Publishing Company, Inc., Los Angeles, Cal.	169
Baker-Raulang Company, Cleveland, Ohio	205-210
Barber Asphalt Company, Philadelphia, Pa.	163
Barrett Company, New York	189
Beall Brothers, Alton, Ill.	248
Beall Tool Company, East Alton, Ill.	255
Bethlehem Steel Company, Bethlehem, Pa.	70½-71-71½-72
Binks Spray Equipment Company, Chicago	151-152
Blaw-Knox Company, Pittsburgh, Pa.	89
L. S. Brach Manufacturing Company, Newark, N. J.	182-183
Brown Rail Loader Company, Boston, Mass.	192

Buda Company, Harvey, Ill.	45-46-47-64-65-66
Carbic Manufacturing Company, Duluth, Minn.	165-166-166½
Philip Carey Company, Cincinnati, Ohio	129-148
Carnegie Steel Company, Pittsburgh, Pa.	268-275
Carter Bloxonend Flooring Company, Kansas City, Mo.	4
Celotex Company, Chicago	6-7
Chicago Bridge & Iron Works, Chicago	85
Chicago Flag & Decorating Company, Chicago	186
Chicago Pneumatic Tool Company, New York	122-123
Chicago Railway Signal & Supply Company, Chicago	108½-109
Chipman Chemical Engineering Company, Inc., Bound Brook, N. J.	50½-51
Clark Car Company, Pittsburgh, Pa.	115
Cleveland Frog & Crossing Company, Cleveland, Ohio	90
Cleveland Pneumatic Tool Company, Cleveland, Ohio	144
Cleveland Railway Supply Company, Cleveland, Ohio	289-290
Concrete Tie Company, Pittsburgh, Pa.	159½
Copperweld Steel Company, Glassport, Pa.	190-191
Creepcheck Company, Inc., Hoboken, N. J.	228-229-230
Crerar, Adams & Co., Chicago	28
Cullen-Friedstedt Company, Chicago	142
Curtin-Howe Corporation, New York	193
Cyclone Fence Company, Waukegan, Ill.	247
Dearborn Chemical Company, Chicago	251-252
Detroit Graphite Company, Detroit, Mich.	58-59
De Vilbiss Company, Toledo, Ohio	288
Dickinson, Paul, Inc., Chicago	98
Dilworth, Porter & Co., Pittsburgh, Pa.	27
Duff Manufacturing Company, Pittsburgh, Pa.	35-36
Edison Storage Battery Company, Orange, N. J.	20
Thomas A. Edison, Inc., Primary Battery Division, Bloomfield, N. J.	18-19
Electric Railweld Service Corporation, Chicago	221-222
Electric Storage Battery Company, Philadelphia, Pa.	40
Electric Tamper & Equipment Company, Chicago	204-211
Elwell Parker Electric Company, Chicago	200-215
Engineering News-Record, New York	155
Fairbanks, Morse & Co., Chicago	73-74-75-76-92-93-94-95
Fairmont Railway Motors, Inc., Fairmont, Minn.	41-42-43-44
Frog, Switch & Manufacturing Company, Carlisle, Pa.	51½-52
General Electric Company, Schenectady, N. Y.	270-271-272-273
General Railway Signal Company, Rochester, N. Y.	48-49-50
Giant Manufacturing Company, Council Bluffs, Iowa	286
Handlan-Buck Manufacturing Company, St. Louis, Mo.	264-279
Hayes Track Appliance Company, Richmond, Ind.	140-141
Headley Good Roads Company, Philadelphia, Pa.	157½-158-159
Howlett Construction Company, Moline, Ill.	250

Hubbar-Jones Corporation, New York.....	203	Oxweld Railroad Service Company, Chicago.....	10-11
Hubbard & Co., Pittsburgh, Pa.....	86-87	P. & M. Company, Chicago.....	119-138
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What's the Answer?

What Our Readers Have to Say on Current Questions That Perplex Those Engaged in Maintaining Tracks, Structures and Water Supply Facilities



QUESTIONS TO BE ANSWERED IN THE MAY ISSUE

1. When going over his section what defects in rail should the foreman look for most closely and how can he do this most expeditiously?
2. Is it practicable to bore holes for sway brace bolts in piles and sway braces before the timber is treated with preservatives?
3. When treated ties released from main tracks are in sufficiently good condition for further service in sidings, should they be turned over when placed in the siding or yard tracks?
4. To what extent should inspection be made of large shops to insure that pulley shafts or other accessories are not attached to structural members in such a way as to overstrain them?
5. What are the advantages and disadvantages of a wide ballast shoulder? Do these vary with different kinds of ballast?
6. What is the best method of providing a water jet for sinking piles on small jobs?
7. To what extent should permanent markers be set for right-of-way lines outside of station grounds? What is the best type of marker for this purpose?
8. What are the relative merits of rigid and telescopic spouts for water columns?

Assignment of Men in Extra Gangs

Is there any advantage in always selecting certain men in an extra gang for certain kinds of work? What disadvantages may result from this practice?

The Practice Promotes Safety and Efficiency

By L. COFFEL

Supervisor, Chicago & Eastern Illinois, Momence, Ill.

While there are many arguments on both sides of this question, I believe that there is a great advantage in always selecting certain men in an extra gang for certain kinds of work. The important considerations in handling men are safety and efficiency, and the foreman who picks his men for the different kinds of work to be done is doing much to secure these results. When laying rail the work is expedited by picking out the best spikers and keeping them at this work, and the same can be said in the selection of men for the other tasks requiring what may be called semi-skilled labor. In laying rail through turnouts, the men who are most familiar with this kind of work should be selected and assigned regularly to this work whenever a turnout is reached. In a steel gang the men of lesser experience should be placed where they will not slow up the work.

In surfacing track, the experienced men should be paired with those of less experience. In this way the track will be more uniformly tamped and consequently less liable to settle out of cross level.

The extra gang foreman who has certain men

whom he can trust, trained for the different kinds of work to be done, is in a position to send these men back from the gang to perform any small jobs that may be necessary without requiring an assistant foreman to leave his work, thus not only making a saving in the cost of the particular work to be done but also contributing to efficiency by not interrupting the supervision of the gang.

Each Man Should Have Definite Duties

By P. J. McANDREWS

Roadmaster, Chicago & North Western, Sterling, Ill.

There is much advantage in selecting certain men in an extra gang for certain kinds of work and having them perform the same task each day, as far as possible. Men who are assigned to certain operations become more skilled through their experience, such skill not only speeding up the work in the particular operation being performed by individual men but, because of the gang as a whole being better organized through the proper placing of men, the output will always be greater in quantity and better in quality.

In rail relaying gangs working with or without mechanical equipment, the selection and assignment of men best suited for certain tasks is obvious, it being essential that each part of the operation be carried on in order and as rapidly as possible so that delays to traffic may be avoided. With the mechanical equipment now coming into general use for rail relaying and other maintenance work, it is essential to rapid and smooth working of the crew

that men be placed where they are best fitted to perform the individual tasks assigned them.

In multiple track districts, it is now the general practice to allow rail laying and ballasting gangs to have a track without interference from traffic during certain specified hours; therefore, extra gangs or other gangs doing such work must be organized with sufficient force to carry on the different operations in order that the maximum amount of work may be accomplished within the assigned hours, and the gang always be kept moving forward. When relaying rail in single track territory or where the use of a track cannot be given to a gang for the work, gangs may be so organized that in the preliminary or follow-up work, men will be given particular jobs to do, and as far as possible the changing of men around will be avoided. In ballasting or other track work, men should always be given definite jobs to do and changing about should be avoided.

The extra gang foreman of experience will quickly be able to pick out men best fitted for the different operations, and properly organize the gang. The writer does not believe there are any disadvantages to such a plan of organizing extra gangs, because present day conditions require that the work be planned so that there may be little lost motion by having gangs waiting for trains.

Men Should Be Selected According to Their Skill

By J. MORGAN

Supervisor, Central of Georgia, Leeds, Ala.

There is always an advantage in using men with certain qualifications for certain work. In our gangs we invariably pick the men for given duties and consider it to the advantage of the service to do so. In all gangs, large or small, there are men who are experienced in some particular kind of track work, so when we have work to be done we use the men best suited to the task. The foreman who knows his men has no difficulty in placing his labor to the best advantage and can often help the service by using an experienced laborer to lead from four to six men of little or no experience in the work they are about to perform.

Doors for Enginehouses

What is the best type of door for enginehouse stalls, from the standpoint of maintenance?

Some Type of Swinging Door Is Satisfactory

By E. A. HARRISON

Architect, Atchison, Topeka & Santa Fe System, Chicago

In the past we have used only two types: rolling wooden shutters and the ordinary swinging wooden doors, the former being used where limited space between the columns at the front would not permit of the doors swinging out. Several objections to this type are found, since doors stuck at any point block the opening, while those not fully raised are stripped out by the smoke stacks on engines. Swinging doors are generally used, and, while not entirely satisfactory, they give fair service. On our latest houses the openings are so large, 15 ft. by 18 ft., that we have to use bi-fold doors in four sections. These doors are hung from columns by heavy wrought iron strap hinges across the full width of the side doors. The two center panels are hinged from the two side doors, the two sections then folding back on each

other and fastening to a post set about four feet from the face of the house. A point to be given consideration is to have the doors firmly fastened when either open or shut to prevent wracking by the wind.

Hinged Doors Are Preferred for Northern Climates

By ENGINEER OF BUILDINGS

From the standpoint of maintenance, the hinged wooden door is usually preferred for northern climates, since, if it is properly made, it will give good service and can be repaired easily by the ordinary maintenance forces, with material that is always available. The doors should be well braced and the hinges heavy enough to support the door without sagging. Where the opening is wide the bi-fold hinged door reduces the tendency to sag as the door is being opened or closed; this type also requires less clearance between the tracks when the door is opened. Rolling doors have been used with good results in many places and have the advantage of not interfering in any way with the clearance of the door opening, but the cost of maintenance is usually greater than for the wooden door in case of an accident caused by a locomotive running into the door before it is opened.

The Second Lift in Ballasting

When making a general raise of track on new ballast, is there any advantage in making the second lift with an augmented section gang rather than with an extra gang?

This Work Should Be Done by the Extra Gang

By F. S. HALES

Engineer of Track, New York, Chicago & St. Louis, Cleveland, Ohio

It is preferable to make the second lift with an extra gang, although I believe that an augmented section gang does slightly better work. The disadvantage of using the section gang is that it takes the section forces away from their regular maintenance work. Making the second lift and dressing will drag over a long period of time, in view of the fact that the section gangs cannot spend their entire time on this work, but must also keep up their regular maintenance.

We find it better to have an extra gang make the second lift and do the final lining and dressing, so that when they leave the job it is complete. This is the surest way to get the work done, and the section men can take care of the low spots as they develop after the extra gang leaves.

No Advantage If Work Is Handled Properly

By J. MORGAN

Supervisor, Central of Georgia, Leeds, Ala.

There is little difference between an extra gang properly handled and an augmented section gang in making the second raise when making a general raise of track, for while it is generally claimed that section men do better work than extra gangs, this is the exception and not the rule. In ballasting track with any kind of ballast and any kind of labor, the way to insure good track is to make the first raise with the same care as to surface and cross level as though it were the final raise, then the second raise can be made with the extra gang with the same

results as if the section gang were used. Uniformity of tamping is the keynote to the best results, no matter what the size of the gang.

Section Gang Will Do Better Work at Lower Cost

By JOHN ANDERSON

Section Foreman, Oregon Short Line, Pocatello, Idaho

When lifting track on new ballast, the reduced cost of the second lift and also the marked improvement in surface, when performed by an enlarged section gang as compared with an extra gang, are quite noticeable, due to the fact that the section men are trained to do honest tamping, to obey instructions, and generally to take pride in their work.

Extra gangs are composed mostly of men who are indifferent in their work. There are usually enough slackers in the gangs to spoil what would otherwise be fairly well surfaced track. By weeding out the slackers, and by kind but strict supervision, extra gangs can be improved materially but even then they will not compare in either efficiency or quality of work with an enlarged section gang under the direction of a capable section foreman.

The Work Will Be Done Better by the Section Gang

By N. F. ALBERTS

General Track Foreman, Atchison, Topeka & Santa Fe, Chicago

If the section foreman is capable of doing the work, there is a great advantage in making the second lift with an augmented section gang, especially when local men can be obtained to increase the gang to the desired size so that the surfacing can be handled properly. This will relieve the railroad of a great deal of expense and inconvenience in furnishing bunk cars, transportation, etc., necessary to take care of extra gang men when imported from other points.

In following this practice, the section foreman should be allowed an assistant foreman and his gang increased to about 25 or 30 men. The assistant foreman must be a sufficiently good track man to take care of the necessary raising, leaving the foreman at liberty to see that the work is carried on properly.

The advantages resulting from this practice may be summed up as follows:

A better job will be done chiefly because the foreman takes pride in the work when it is done on his own territory;

It induces the foreman to take a deeper interest in putting up his track as it should be put up, while if done by an extra gang under the supervision of an outside foreman, it is often neglected. This causes the track to be left in a rough riding condition which later necessitates attention and additional work by the regular section gang, thus increasing the cost of track maintenance;

It promotes a greater degree of confidence in the section foreman, which tends to cause him to have a better feeling towards his superior officers as well as to become more enthusiastic about his work, thus resulting in efficiency, economy and safety.

There is a slight disadvantage in following this practice where the section foreman may not be familiar with both the handling of a large gang and making a general raise. A situation of this kind may be overcome by doubling such a gang up with an adjoining section gang having a foreman capable of doing the work. In such cases the neighboring foreman must be placed in charge of the surfacing and the less capable foreman should assist in the work. This will be of great benefit to him by giving him an opportunity to perfect himself so that later

on he will be able to handle the work without the necessity of calling on his neighboring foreman.

The practice of having extra gangs make the second or final lift not only creates ill feeling on the part of the section foreman on whose territory the work is done, because of improper handling, but causes unnecessary expense to the company, since the salary of an extra gang foreman is usually higher than that allowed the section foreman. In most cases after an extra gang has finished a piece of track it is necessary for the section gang to go over this work and put in a great deal of time in correcting the irregularities left by the extra gang. Even though in charge of a competent foreman, work of this kind done by extra gangs is usually neglected. It seems to be the aim and purpose of most extra gang foremen to make a good showing by delivering the work in quantity rather than quality.

Seasoning Creosoted Piles

What interval, if any, should elapse between the creosote treatment of a pile and its use in a trestle?

Creosote Oil on Surface Should Be Allowed to Dry

By G. A. HAGGANDER

Bridge Engineer, Chicago, Burlington & Quincy, Chicago

We have no rule on this matter on the Burlington, and in many cases piles are shipped out for driving the same day that they are taken out of the retort, although usually they are treated and stored for a period of from one to six months before being used. It is desirable to store them for some time before use so that the creosote oil on the surface can evaporate, since it is very disagreeable to handle a freshly treated pile. I know of no reason for not using a freshly treated pile except the matter of handling.

Little Advantage in Storage After Treatment

By C. F. FORD

Supervisor Tie and Timber Department, Chicago, Rock Island & Pacific, Chicago

From the standpoint of service and life of the timber, there is no reason why creosoted piles should not be installed immediately after treatment. However, the fire hazard is increased somewhat if freshly treated piles are unloaded at the site of the work some time in advance of their installation. For this reason it is desirable to store creosoted piles for a period of from four to six months after treatment if it can be done conveniently, to allow the volatile oils to evaporate. The advantages gained by this procedure are not great enough, however, to make it worth while to interfere with programs of work to permit this being done.

Creosote on Surface Should Be Allowed to Dry

By R. S. BELCHER

Manager Treating Plants, Atchison, Topeka & Santa Fe System, Topeka, Kan.

It is difficult to set a minimum length of time which should elapse between the creosote treatment of piling and its use in a trestle. The character of the creosote, kind of wood, amount of sapwood, climate and length of final vacuum used in the treating process, all enter into this question.

Undoubtedly the piling should be dry on the surface when placed in a trestle, chiefly as a matter of fire protection. Some good information along the

line of resistance of creosoted wood to fire is given in the report of the Committee on Wood Preservation of the American Railway Engineering Association for 1925.

Experience on some of the divisions of the Santa Fe indicates that creosoted pine fence posts and telegraph poles do not ignite as readily, neither are they damaged as much by grass fires as untreated posts and poles, and one division superintendent has told me that he has never known a creosoted fence post or a creosoted pole on his division to be destroyed by fire, despite the fact that during the winter months there are many grass fires on the territory under his supervision.

Reducing the Discharge of a Centrifugal Pump

When it is desired to reduce the volume of discharge of a centrifugal pump for any length of time, how should this be done? How will the operation of the pump be affected if the discharge pipe is constricted to accomplish the purpose?

Change the Impeller if Large Reduction Is Made

By W. S. McCaleb

Engineer of Water Service, Pennsylvania, Philadelphia, Pa.

When the pump is direct-connected to a constant speed prime mover and where the reduction in output is not excessive or where the period during which the reduction desired is short or spasmodic, the simplest way is to choke a valve on the discharge side of the pump. The power input will be reduced with the output of the pump, but the efficiency of the pump will fall off and the head imposed upon the facilities up to the choked valve will be increased. This increased head may or may not be of importance, but it involves a waste of power.

Under certain ideal suction conditions and where the desired reduction in output is not too great, it may be advisable to choke a valve on the suction side of the pump. Experience has indicated that, under certain conditions, the power input is less for a given output where the rated capacity is reduced by choking a valve on the suction side of the pump than where the same reduction in output is accomplished by choking a valve on the discharge side of the pump. This arrangement, in my opinion, should not be adopted until a thorough study has been made of the local conditions.

For reasonable reductions in output, the choking of a valve on the discharge side of the pump will not injure the pump in any way, nor will it interfere with the normal operation of the unit. Where the reduction in output is excessive, i. e., 80 to 90 per cent of its rated capacity, the pump would be subjected to internal hydraulic shocks, the effects of which are not unlike the wire drawing of valves when they are closely throttled. In my opinion, the choking should be accomplished by the operation of a valve which is located some distance from the pump flange.

Where the desired reduction in volume is a considerable percentage of the rated capacity and where the reduction in capacity is desired for a somewhat extensive period, I believe that the most economical and desirable thing to do is to purchase a new rotating element. The characteristic curves of the unit to be purchased should be studied. Having then the

characteristic, the cost of power and the cost of a new rotating element, one can readily decide the economy of a new rotating element.

Where the pump is driven through gears, belts, etc., it is also possible to change the output by changing the speed. In general, however, such an arrangement is expensive and is attended by a material loss in the efficiency of the pump. Obviously such a method would not be adopted unless the speed can be changed quickly and at slight expense. Before permitting such an arrangement, I would suggest calling on the pump manufacturer for characteristic curves at the revised speed and, from these new curves, compute the cost of operation at the revised speed.

As a general rule, therefore, my opinion is that where the changed operating conditions are spasmodic or for comparatively short periods of time and for reasonable reductions in output, the reduction should be arranged for by choking a valve on the discharge side of the pump. Where the changes in operating conditions are more or less continuous and for a greater length of time, I would suggest that a study be made and the economy of a new rotating element be ascertained.

The manufacturers can predict the characteristics of a new impeller quite closely. The tolerance in the construction of pumps manufactured by reputable companies is very close, so that the changing of rotating elements is simple and rapid, and involves no maladjustments, risks of heating, or other injurious results.

Throttling the Discharge Line Is Not Injurious

By J. P. HANLEY

Water Service Inspector, Illinois Central System, Chicago

The centrifugal pump is rapidly superseding the displacement pump in present day installations owing to the fact that it costs less to install and maintain and requires less floor space than displacement pumps of similar capacity.

In ordering centrifugal pumps a careful check should be made of the delivery required or economical under the existing conditions. When possible the actual total head, including friction, should be obtained by means of pressure and vacuum gages. This can usually be done where a centrifugal pump is ordered to replace another type of pump, as the gage readings may be taken under approximately similar delivery conditions while the old pump is in service. Such gage readings are useful in connection with old piping systems, as they indicate the extra friction caused by incrustations or other obstructions in the piping. Where a new installation is made the head should of course be computed carefully from elevations and friction tables or formulas.

However, there are cases where a centrifugal pump delivers more water than desired, due to a decrease in head caused by a high water stage in the river from which the pump obtains its supply, increased size of renewed discharge lines, too liberal an estimate originally made for friction or other local conditions.

In such cases if the total head fluctuation is excessive or, in other words, considerably lower than that originally figured, the result, ordinarily, is an increased capacity of the pump in gallons per minute and a possible overloading of the motor or driver. In such cases correction can be made by throttling the gate valve in the discharge line, thus building

up the head and cutting down the capacity of the pump to the approximate condition originally figured on and keeping the load well within the horsepower of the driver. Such a procedure would have no bad effect on the pumping unit, merely building up the velocity of the water as discharged.

On the other hand, with a lower head than that actually figured the resultant increased capacity of the pump would overload the motor and cause it to heat, which, of course, must be avoided. The throttling of the gate valve in the discharge line, with the resultant operation of the unit under the conditions for which it was designed, eliminates the overload condition and its injurious results to the unit.

Mixing Concrete for Small Jobs

What is the smallest amount of concrete which will warrant the use of a mixer?

Few Jobs Are Too Small If Mixer Is Available

By A. B. SCOWDEN

General Bridge Inspector, Baltimore & Ohio, Cincinnati, Ohio

There is too much variation in both character of equipment and conditions of work to permit any definite rule as to the minimum amount of concrete which will warrant the use of a mixer. The matter should be left largely to the judgment of the field man in charge, who will know what equipment is available, how and from where it will have to be transported, the quantities to be installed and the local conditions under which the concrete will have to be handled. In general, however, I consider the following as fair working rules:

1. Where the gang which has to do the work carries in its regular tool equipment a small, easily portable gasoline-operated mixer (for half bag or one bag batches), there is practically no minimum limit, even if the cost of handling this mixer from the tool car to the site and return is not fully compensated for by the saving in the cost of mixing, since the gang carrying such equipment will have experience in machine mixing and will produce a better quality of concrete than by hand work.

2. Where the mixer must be transferred from division headquarters or some other point on the division, a job containing as little as 10 to 15 cu. yd. of concrete will often justify such transfer.

3. When the mixer must be furnished from a system storage point or from some other division, it has been my experience that the cost of transferring equipment is generally justified for jobs of 20 cu. yd. of concrete or more. It is apparent, in such cases, that judgment should be used in selecting equipment, sending the lighter and more easily handled mixers to the smaller jobs and sending the large and heavy mixers, particularly those requiring a boiler for steam operation, to a location where considerable yardage is involved.

In general, I believe that preference should be given to machine mixing, not only from a cost standpoint but also on account of the better mixing and more uniform character of the concrete obtained. Concrete turned by hand in the proper manner involves a very high labor cost and does not have the uniformity of the product well mixed by machine. The advantage of machine mixing for the large jobs has long been recognized; the small, readily transported gasoline-operated mixers which have been

placed on the market in recent years have extended the field to smaller jobs. These machines represent a small outlay, are simple in operation, can be handled readily on a push car, are easily unloaded at the site by hand and readily moved around at the site, permitting the concrete to be placed close to the location of final deposit and reducing the handling in the forms. With these machines available, there will be little work which justifies hand mixing.

Equip Maintenance Gangs with Small Mixers

By J. S. HUNTOON

Assistant Bridge Engineer, Michigan Central, Detroit, Mich.

The concrete mixer is a labor saving device and has proved so economical that no one considers mixing by hand on the larger jobs, particularly those of more than over 100 cu. yd. Every railroad has numerous small concrete jobs, particularly repair work, which are handled by the regular maintenance forces. If these forces are provided with small portable mixers as a part of their regular tool equipment, they can be transported to the bridge site on a push car at the same expense as handling material for a mixing platform.

Under these conditions, all concrete should be machine mixed when it amounts to as much as three to five cubic yards or where it is required to be dense and of the best quality, such as for floor slabs and when placed under water. When the amount of concrete exceeds 10 cu. yd., hand mixing should be discouraged, as the desired results are not always attained. There is also a tendency on the part of workmen to use an excessive amount of water in mixing to save themselves labor.

I would suggest, as a general rule, that the smallest amount of concrete to warrant the use of a mixer is the amount that could be mixed by hand in one day by an average gang and in no case should the amount of hand mixed concrete exceed 50 cu. yd., regardless of the size of the gang.

Uniform Frost Action in Ballast

What is the most effective means of inducing uniform frost action in the ballast? Will this method have any effect on the uniformity of frost action in the subgrade?

Full Ballast and Subgrade Sections Will Help

By A. C. MacKENZIE

Engineer Maintenance of Way, Canadian Pacific, Eastern Lines, Montreal, Que.

The most effective means of inducing uniformity of frost action in the ballast is, of course, to have a uniform depth of ballast with uniform moisture content, together with uniform moisture content of subgrade. This ideal condition is not by any means general, and in order to produce even frost action it is frequently necessary to treat spots where, due to greater exposure to the frost or greater moisture content, the action of the frost is uneven. Treatment according to location may consist of providing French drains, deeper ditches, tile drains, or of digging out the heaving material and backfilling with clean ballast. Any treatment, especially the latter, must be performed carefully so that the treated portion will heave uniformly and sufficiently to keep in surface with the balance of the track. When digging out is resorted to it is usually best to run the excavation out gradually, usually in about a rail

length. If uniformity of frost action can be obtained in the ballast section it has its beneficial reflection on the frost action in the subgrade.

It is of importance to have a full subgrade and a full ballast section in order to avoid excessive frost action under the ends of the ties and also to prevent frost leaving the shoulders too quickly, which results in centre-bound track.

Proper Drainage and Clean Ballast Are Essential

By LEM ADAMS

Roadway Assistant, Union Pacific, Omaha, Neb.

These two questions are so related that their discussion should be handled together. Proper drainage is the essential factor for frost elimination; therefore, if surplus moisture is eliminated from the subgrade there will be very little occasion for frost action in the ballast, as in most instances frost works up from the bottom into the ballast.

If a sufficient cushion of good, clean ballast is provided, surface waters will drain off quickly and moisture from the roadbed will not work up into the ballast to cause much serious trouble. Therefore, we may say that the two essential items for retarding frost action in track are proper drainage and clean ballast.

Lengths of Switch Points

Are the savings to be gained by designing switch points of such length that they can be cut from 39-ft. rails without waste, great enough to overcome the extra expense which the change of standards would involve?

There Would Be No Economy

By G. J. SLIBECK

Chief Engineer, Pettibone, Mulliken Company, Chicago

In this question the item of savings does not enter for the reason that the manufacturer at present has an outlet for his rail crops in the manufacture of heel risers, separator blocks and units of that sort. In the earlier days when rails were 30 ft. or 33 ft. long, most of these accessories were made of cast iron or cast steel, and consequently there was a saving in the cutting of several guard rails or two switch points from a single rail, but that situation no longer obtains. It makes no difference to the

manufacturer what length of rail the railway company decides to use.

There will probably be some railways which will adopt a 19-ft. 6-in. switch point. This length of point will probably become standard with rails of 130 lb. and over, and of course with the use of this length in new turnouts there will be no additional expense to the railroads in new work, although there will be some in work where lighter rail is relaid with the heavier rail. On the other hand, the American Railway Engineering Association now provides for switch points 11 ft., 16 ft. 6 in., 22 ft. and 30 ft. long, and these lengths, in my opinion, should remain without the addition of any extra lengths in switch points.

No Advantage in Changing Standards on This Account

By C. W. BREED

Engineer of Standards, Chicago, Burlington & Quincy, Chicago

If one manufacturer makes the bulk of switch points, frogs and crossings for a railroad, as in the case with many railroads, there is little waste of rail regardless of the length of the point. For instance, if two 16-ft. 6-in. points were made from a 39-ft. rail there would be left 6 ft. which could be used nicely as a wing rail or side on certain crossings.

The disadvantage of putting into service switch points 19 ft. 6 in. instead of 16 ft. 6 in. long is the increase in the length of the lead, which requires more ties and adds considerable standard material to a list already too large. I do not favor providing for more standards than we have in our present A. R. E. A. manual unless more benefit is apparent.

Longer Points Involve Waste

By J. MORGAN

Supervisor, Central of Georgia, Leeds, Ala.

Switch points which can be cut from 39-ft. rails without waste would be either 19 ft. 6 in. or 13 ft. long. As the present 16-ft. 6-in. switch points are satisfactory for ordinary turnouts, lengthening them three feet really involves a waste of material, since the points wear faster than the ordinary rail. On the other hand, points 13 ft. long are too short for any turnout over a No. 7. The six feet of rail left after cutting two 16-ft. 6-in. points from a 39-ft. rail can be used in making frogs or crossings so that ultimately no waste will result.



Gwynns Falls Bridge of the Pennsylvania near Baltimore, Md.

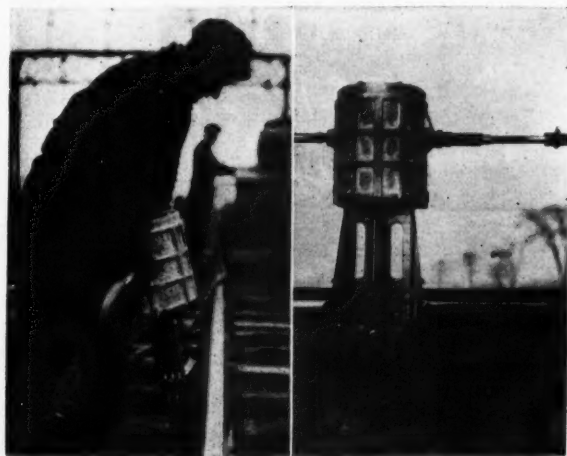
Getting the Manufacturers' Help

New and Improved Devices That Save Labor



A Pneumatic Machine for Pulling Spikes

THE Ingersoll-Rand Company, New York, has developed and placed on the market a pneumatic spike puller to supplement its pneumatic spike driver, for the purpose of effecting savings in both time and money in rail relaying work. The device consists of an air cylinder mounted on a base which rests on the tie and the base of the rail and which also forms a guide for the travel of the piston rod. A pair of nippers, which engage the head of the spike, is attached to a toggle, which in turn is attached to the lower end of the piston rod. When



The Ingersoll-Rand Spike Pulling Machine

air is admitted to the cylinder to force the piston upward the leverage of the toggle increases the lifting force exerted by the cylinder head sufficiently to pull the spike, the nippers closing on the spike head the instant the piston begins to move. An air pressure of from 80 to 90 lb. is used, depending on the holding power of the spikes. The machine weighs about 70 lb. and can be handled easily by one man, the weight being kept down by making the cylinder of aluminum.

An extensive test of this machine was made recently on the double-track main freight line of the Chicago & North Western between Nachusa, Ill., and Dixon. This line was built in 1909 and, except on a light curve, the original rail had not been

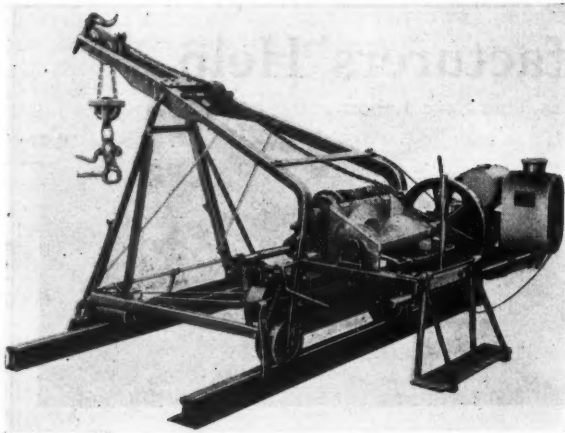
changed at the time the tests were made. Ninety per cent of the ties were white oak and $\frac{5}{8}$ -in. spikes were used with tie plates punched for $\frac{1}{4}$ -in. spikes, causing increased friction when the spikes were drawn. Time studies of one-minute intervals showed maximums of 14 spikes, 11 spikes, 9 spikes and 8 spikes pulled per minute, with an average of 6 spikes per minute, over a continuous four-hour period. The time for pulling spikes with ordinary claw bars was also tested and the best average for this method was 3 spikes per minute. It was also found that the spikes removed by the machine were straight after being pulled, while those withdrawn by claw bars were bent in pulling. On another test on the Pennsylvania, 42 spikes were pulled in $1\frac{1}{2}$ min., with two machines, an average of 14 spikes per minute for each machine.

Mechanical Power Applied to the Three-Man Rail Layer

WITH THE advent of heavier and longer rails, the Maintenance Equipment Company, Chicago, has developed a machine similar to its manually-operated three-man rail layer, which it has equipped with a gasoline engine to supplant hand labor on the hoist, thus speeding up operation and enabling the machine to handle the heaviest rails easily. It is said that 130-lb. rails have been laid at the rate of two rails per minute with this device. While the general design of the machine has not been changed, the structure has been strengthened and steel forgings have taken the place of castings on the frame. The power-operated machine can be removed from the track by lifting it off the rails in the same manner as the hand-operated machine and the lifting handles are designed to allow plenty of room for the men necessary to do this.

Power is supplied by a five-horsepower, two-cycle gasoline engine in which special attention has been paid to the governor and the elimination of vibration. Transmission to the hoist is by means of a double-cone clutch, both raising and lowering being done under power, while the drum is automatically self-locking when the power is released, thus affording complete control in the lowering of the rail with consequent freedom from accident in that operation. The clutch mechanism is covered while the machine is in use, both to safeguard the workmen from injury and to protect the machinery from the weather.

Friction is reduced to a minimum by the use of



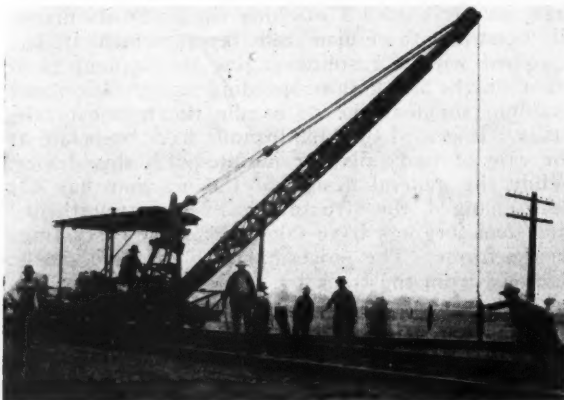
The Three-Man Rail Layer with Gasoline Engine

roller bearings for all wheels and rollers, ball bearings for the friction shaft and ball thrust bearings for the worm gear which operates the hoist. Both rail clamps, which fit any section of rail, are actuated by the operator.

The Fairmont-Parsons Crane for General Utility Work

THE Parsons rail crane, manufactured by the Parsons Company, Newton, Iowa, which was described in the May, 1926, issue of *Railway Engineering and Maintenance*, has been converted into a general utility crane and is now known as the Fairmont-Parsons crane, the Fairmont Railway Motors, Inc., Fairmont, Minn., having taken over the marketing of this machine.

The boom has been made heavier than formerly and additional outrigger clamps have been added, permitting the crane to operate a clam shell bucket for handling coal, cinders, ballast or concrete aggregate.



The Fairmont-Parsons Crane Laying Rail

gates. Provisions have been made for the addition of an electric generator for operating electric track or other tools, or a lifting magnet, while the crane may also be equipped with an air compressor for driving pneumatic tools. A rack has been added at the rear of the machine to hold scrap or ballast as a counterweight. A portable turntable can be furnished for mounting the crane on a flat car, enabling it to load or unload ties, rail or other material from

a car on either side of the flat car, thus making a marked reduction in switching in work train service. If desired, the crane may be equipped with a standard coupler so that it may be used to spot cars.

These changes, while not interfering with the use of the crane for laying rail, have been designed to extend its field of use so that it may be kept busy throughout the year.

A Heavy-Duty Motor Car

THE BUDA Company, Harvey, Ill., has placed on the market a heavy-duty motor car which it has designated as No. 619 and which, in addition to transporting large gangs of men, is of sufficient power to serve as a work service car, with consequent elimination of work train service. The car is 14 ft. long but longer frames may be supplied if desired. The maximum load capacity for the standard car is 8,000 lb. The car may be furnished with either two-wheel or four-wheel drive and may also be equipped with various models of engines, depending on the power desired, including three models of four-cylinder engines ranging from 37 to 49 hp. and four models of six-cylinder engines ranging from 57 to 114 hp. The cars can be built for any speed up to a maximum of 50 miles an hour, depending on the gear ratio selected to suit the loads and class of work. For heavy hauling and steep grades a low gear ratio is recommended, reducing the maximum speed but giving greater power.

The engine is equipped with a high tension magneto and impulse coupling for easy starting at slow



The Buda No. 619 Will Carry Large Gangs

speed, a Zenith carburetor with dash type flexible wire choke control, a vacuum tank, a water pump, an oil-pressure gage on the dash board and a four-bladed fan mounted on ball bearings. If desired the engine may be equipped with an electric starting motor, generator and battery. The radiator is of the cellular type with cast iron top, sides and bottom, and the water circulation is maintained by a centrifugal pump mounted on the engine and driven from the cam shaft gear, the capacity being ample to permit the operation of the car in the reverse motion without overheating.

The transmission is of the heavy duty automotive type, with multiple disk clutch, equipped throughout with ball bearings and with gears of hardened alloy steel. Three speeds are provided in each direction, and the drive between the transmission and the reverse gear is through a flexible fabric type of universal joint, while the final drive from the reverse gear shift to the axles is by means of a roller chain

and sprockets. The control levers are mounted in the center of the car, directly back of the engine, and include a gear shift lever, a reverse gear lever, a hand brake lever and a foot clutch lever. If desired, the control levers may be located at the extreme left front end of the car at the side of the engine. The gasoline tank has a capacity of 25 gal.

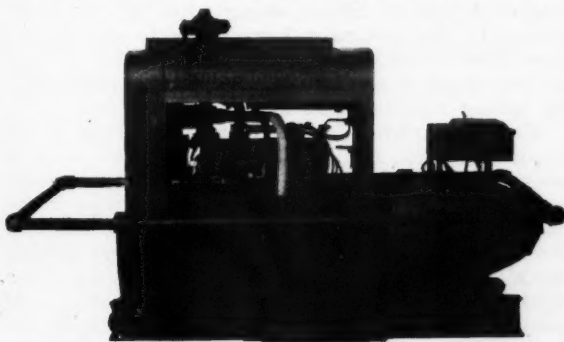
The frame of the car is built up of heavy five-inch channels, with gusset connections, hot riveted. The axles are of heat treated nickel steel, three inches in diameter, running on Bower roller bearings enclosed in steel housings. The wheels are of forged steel and are 24 in. in diameter. The brakes, which operate on all four wheels, are of the external contracting band type with Raybestos brake lining, and the brake rods are fitted with compensators for equalizing the brakes. The standard wheel base for the four-wheel drive is 8 ft. and that for the two-wheel drive is 8 ft. 6 in. Long semi-elliptic springs are provided, with spring thrust plates whereby side sway of the car is prevented.

The size and power of the car make it available also for large inspection parties as well as for other purposes and it may be equipped with various types of body to adapt it to such uses.

Syntron Company Develops New Electric Tamping Outfit

THE Syntron Company, Pittsburgh, Pa., has developed and is now delivering to several railways a new electric tie tamping unit with six tampers. The generator for the new outfit, while of greater power, has been kept to the same size and weight as the one for the four-tamper unit, thus providing two additional tampers at a small increase in initial cost.

In adopting the six-tamper unit, the company was guided by its own experience and that of various railways to the effect that a unit of this capacity will permit the work to be carried on more efficiently and at much less cost than with four tampers. With



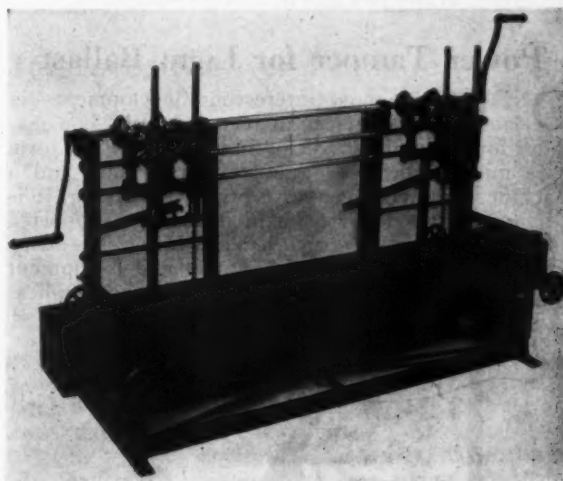
The Portable Power Unit for the Six-Tamper Outfit

the latter outfit it is the custom to tamp the ties on the outside, from the end of the tie to a point well under the rail, and then to move back to tamp the ties between the rails. Since the ties are not tamped as solidly between the rails as on the ends, this second operation was performed in less time than the first, and it was found that two men with tampers between the rails could keep pace with the four men tamping the outsides of the ties, thus completing the track as the gang moved forward, with no lost motion.

The power plant for the six-tamper unit consists of a 24-hp., 4-cylinder, tractor-type gasoline engine, which is water-cooled and equipped with force feed lubrication. The engine is direct-connected to a 10 k.v.a., 110-volt, 25-cycle, 3-phase electric generator mounted on steel skids. Flanged rollers are provided between the skids to permit the unit to be moved along one rail of the track with little effort, while side rollers are also provided for rolling the machine along a plank from the rail to the shoulder of the roadbed. The width of the unit is 20 in., thus permitting its use where clearances are limited.

A New Tie Boring Machine

A NEW machine, which is designed for boring spike holes in ties at various points along the right-of-way, and thereby precluding the necessity of sending the ties to a boring plant, has recently



The New Track Tie Boring Machine

been put on the market by the Track Specialties Company, New York. This machine, which is known as the Triana tie boring machine, is operated by either one or two men, and is designed to bore four holes at one time. Owing to its light weight, which is only 265 lb., it can be moved from place to place, where ties are assembled, with little difficulty.

Essentially, the new boring machine consists of a metal frame for supporting and holding the ties, and for holding the drills and operating mechanism. This frame, which has four upright back members, is made up of heavy angle iron and plates which are bolted, riveted or welded together. The four back members of the frame form bearings for the crank shaft, and also for two other shafts on which the drill heads are fastened.

All shafting of the machine is of cold rolled steel, and the steel gears of the driving mechanism are securely fastened to the shafts with steel keys. All castings are made of malleable and gray iron, and all bearings are extra large and are fitted with oil holes. The drill spindles are of forged steel, accurately machined to take round shank wood bits, which are held in place by set screws. The four drilling heads of the machine, mounted on the back shafts, are all adjustable in order to take care of various track gages, and also various widths of the bases of rails.

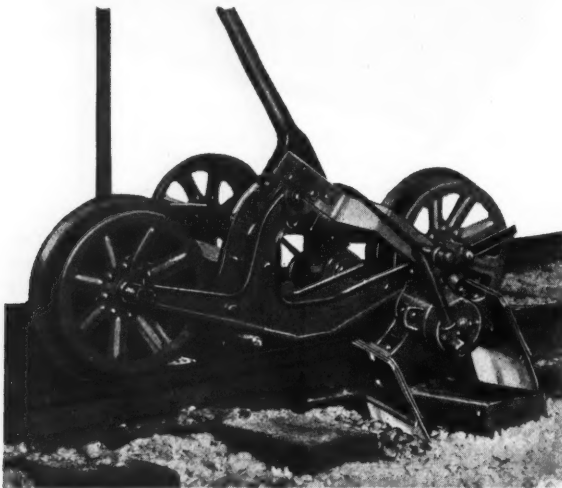
The new tie boring machine is made with a base

of sufficient size to receive ties of any shape up to 8 in. by 12 in. The ties are put into place in the machine from the front side, and are held in position by four hand-operated binding screws. These screws, which are fitted with large hand wheels for easy operation, have ends sufficiently pointed that they hold rigidly even a most irregular tie, while drilling is under way.

The machine is operated by a hand crank at each end of the main frame, which transfers the force applied through the operating shaft and gear mechanisms for operating the drills. Through the reduction provided, drilling is rapid, it being claimed that less than five minutes is required to place a tie in the machine and to drill four holes to a depth of six inches. The bits are withdrawn from the holes by two compound leverage bit-drawing attachments, which draw the bits in a vertical position out of the holes without injury. Each of these attachments draws two bits in a single operation.

Power Tamper for Light Ballast

ONE OF the most interesting developments in labor-saving devices in recent months is a machine for tamping gravel or light ballast. In form it is midway between a strictly hand tool and a machine mounted on a car. Strictly speaking, it is a hand-controlled device, with its weight supported on a three-wheeled truck. The device has been brought out by the Electric Tamper and Equipment Company, Chicago, and comprises a further applica-



How the Blades Straddle the Tie

tion of the electric motor with an eccentrically loaded rotor, which has been in use for a number of years in the electric tamper manufactured by that company.

The three-wheeled truck includes a light structural frame to connect the outrigger wheel with a heavy cast frame that is supported by two wheels riding the same rail. The primary purpose of this heavy frame is to provide the pivot or fulcrum for the support of a lever which may be moved through a considerable angle in a vertical plane directly over the rail. The rear or long end of this lever consists of a wooden bar or handle, while the other end is in the shape of a fork, composed of a pair of steel bars bent outward away from the side frame of the

truck, the lower ends of these two bars serving as the supports for the tamping devices, one on each side of the rail. The purpose of this lever arrangement is to permit the operator to raise or lower the tamping devices by moving the wooden handle up or down, the relative length of the lever arms being such that this can be done with little physical effort.

Each tamping device consists of the standard motor unit that has been in use for several years as the



Two of the Machines Operated in Tandem Formation

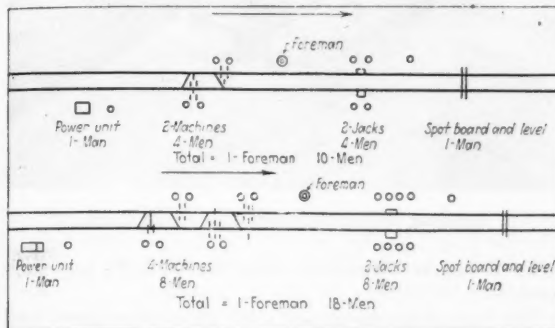
actuating device for the electric tamper. This unit is mounted in a special frame, having an arm cast on each side of it, to which the tamping blades are attached, the length of the arms being such that the two blades will be well clear of the sides of the largest tie when the tamper is lowered over it.

The blades are of tool steel with reinforcing plates at the points of attachment to the arms and have been given a peculiar curved shape which was adopted after extended experiments with various forms of blades for the purpose of determining the shape which would give the desired results. Each tamper unit is attached to the end of the supporting lever with a piece of leather belting so that the tamper is free to tilt or swing while in operation. Owing to the particular form given to the blades, they have a tendency to swing in toward the rail as they work down into the ballast and thus pack the ballast tightest close to the rail bearing.

When not in use or when the truck is being moved along the track, the handle of the tamper lever is hooked down to the frame, thus raising the tampers high enough so that the blades clear the tops of the ties. When ready to tamp a tie the operator unhooks the handle with one hand and spots the car so that the blades will straddle the tie, using his foot or a rigid handle attached to the frame to get the car in the right position. As soon as the blades strike the ballast the oscillating movement generated by the electric motor at the rate of 4,000 blows per minute causes the blades to work down into the ballast, the curves at the lower ends of the blades forcing the ballast under the ties. However, this effect can be intensified by the operator shifting the truck forward and back along the track, thus giving the tamping units an inclined position so that first one blade and then the other is forced under the tie.

In addition to the operator, the machine is attended by a helper who looks after the conductor cable and uses a shovel to feed additional ballast to the blades whenever this is necessary. The complete organization for the work depends upon the number

of machines in use. The smallest operating outfit consists of two machines, one right hand, working on the right rail, and the other left hand, working on the left rail, so that the two operators face in the same direction and move forward from tie to tie along the track. The gang organizations for two-machine and four-machine outfits are shown in the sketch. The machines all work in the same direction just far enough apart to avoid interference. If two machines are being used, they tamp every tie



Suggested Organizations for Two-Machine and Four-Machine Outfits

in turn. With four machines, the two in advance tamp every second tie, while the two following machines tamp the ties between.

It is claimed that two machines, making a lift of from one to three inches, will surface 250 track ft. per hr. with a gang of 10 men and a foreman and that four machines with a gang of 18 men and a foreman will double this output. Attention is directed to the fact that the two tampers on a machine are independent self-contained units with separate push-plug electrical connections. In case one of these units should give trouble for any reason it requires but a few minutes to disconnect it from the machine and replace it by a spare unit until the necessary repairs can be made.

A New Woodings Rail Anchor

THE Woodings Forge & Tool Company, Verona, Pa., has brought out a new model of its rail anchor in which the portion below the rail has been enlarged to afford a greater bearing against the face of the tie. The anchor is a one-piece device, made of heat-treated, high carbon steel, which clamps on the base of the rail, where it is held firmly by spring



The New Woodings Rail Anchor Has a Large Yoke

action which is brought into play by the shape of the anchor and the method of application.

One end of the anchor is made in the shape of a hook which engages one edge of the base of the rail, while a recess in the other end grips the other edge of the rail base when the anchor has been applied. The anchors may be applied or removed by one man with no other tools than a spike maul and may be re-applied as many times as desired. In applying the anchor the hook is placed over the inside edge of the base of the rail, with the anchor extending under the rail and with the other end held up by the toe of the trackman, who stands on the end of the tie. When the anchor is in this position a light blow of the maul will cause the hook to grip the rail and one or two blows on the yoke will cause the other end of the anchor to slide up along the outer edge of the base of the rail until the recess is engaged. These anchors may be made to fit any section of rail.

Improved Sprayer Leads to New Weed Killer Service

THE Chipman Chemical Engineering Company, Inc., Bound Brook, N. J., is now offering its chemical weed killer service in a new form, namely, that of loaning equipment to the railroads with which they can apply the chemical with their own forces. This plan has been made possible by the development of new spray equipment which is so designed that the application of the solution is automatically adjusted to the speed of the train and the number of nozzles in service, thereby obviating the need of an operator who has learned by experience how to adjust the discharge from the nozzles to meet the changing conditions encountered.

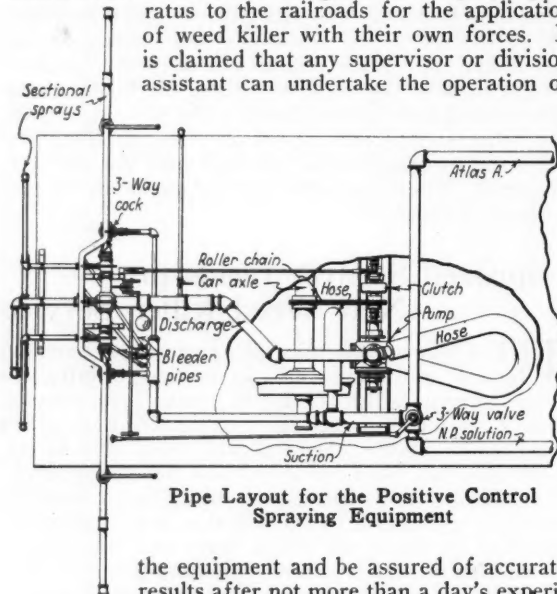
With the old equipment, accuracy of treatment was dependent largely upon the judgment of the operator as to the speed at which the train was traveling, and it has been found that such judgment is frequently inaccurate by 20 to 30 per cent, particularly at low speed. Another factor of inaccuracy lies in the fact that the pressure required for the discharge of the solution was formerly obtained from the brake pipe and obviously varied within the range of the pressures in the train line. Still another source of inaccuracy resulted from the change in pressure on the nozzles following the turning off or on of some of the sectional sprays. Cutting out some of these sections resulted in higher pressure on those remaining in service and vice-versa.

As a result of these elements of inaccuracy it is estimated that the weed-killer dosage has varied as much as 30 to 40 per cent in many cases. In the hands of a skillful operator the old equipment was more or less successful, while in the hands of a less experienced operator, dosage varied to such an extent as to be wasteful under some conditions and inadequate under others.

To overcome the disadvantages of the old equipment the new machine is provided with a rotary pump, driven from one of the axles of the flat car upon which it is mounted. Care was taken to select a pump in which the discharge varies in direct ratio to the speed of rotation within the limits corresponding to train speeds of from 10 to 25 miles per hour. Another feature of the new machine is the application of three-way cocks for the control of the individual section sprays, with bleeder pipes leading from

the cocks to the suction line of the pump. With this arrangement, the cutting off of the flow to any of the section sprays does not stop the flow in the branch pipe leading to it. Instead the solution continues to flow through the bleeder pipe back into the suction line. Consequently, the shutting off or turning on of one or more of the sections results in practically no change in the pressure on the nozzles remaining in service.

Because of the advantages of this equipment the manufacturer is now offering the new spray apparatus to the railroads for the application of weed killer with their own forces. It is claimed that any supervisor or division assistant can undertake the operation of



Pipe Layout for the Positive Control Spraying Equipment

the equipment and be assured of accurate results after not more than a day's experience. Primary among the advantages claimed for this plan is that it will enable the railroads to carry on weed-killing operations independent of the schedule set up by the contractor for the operations of his own trains over the lines of the various railroads with which he has service contracts. Attention is also called to the fact that adoption of this plan by a considerable number of railroads will enable the contractor to reduce his own service organization and thereby effect economies which will result in a definite saving to the railroads.

The new equipment was employed last year on the Canadian Pacific, the Detroit, Toledo & Ironton, the Fort Worth & Denver City and the Canadian National and has therefore been thoroughly tested.

Northwest Crawler Cranes Perform Varied Service

ABOUT five years ago the Chicago, Burlington & Quincy, after a study of the use of crawler cranes designed to be converted into drag lines or power shovels at will, purchased a crane of this type from the Northwest Engineering Company, Chicago, since which time it has added four more to its equipment for maintenance work. The Burlington was prompted to this action by the successful operation of such cranes by contractors doing work for them and the desirability of having the machines available for its own use at all times without having to depend on the chance of finding a contractor with the requisite outfit.

This road has an extensive mileage in the alluvial bottoms of the Mississippi and Missouri rivers and

is frequently called upon to dig ditches and channels or to build levees to care for the proper flow of water. The yardage involved in such work is usually comparatively small and the ability of these machines to operate economically under the conditions met



Loading Ballast Without a Spotting Crew

with in such situations fits them well for such work.

The cranes are equipped with gasoline engines and require only one operator and a helper. The cost of handling fuel is low and no water supply is necessary, both of these factors reducing the cost of operation. The machines are loaded quickly on flat cars under their own power and require no elaborate "setting up" before beginning work, or "taking down" after its completion. When loaded on a car, the width and height are such that no trouble is encountered with clearances.

While the cost per yard of material handled varies with the local conditions, it usually runs from 23 to 33 cents for surface ditches and from 15 to 18 cents for levee work, these figures including "rental," an interdepartmental charge to cover inter-



Northwestern Crane Driving Sheet Piles on the Burlington

est and depreciation on the machine. On a recent channel change in Wisconsin, involving 9,987 cu. yds. of excavation, the work was completed in 11 days at a total cost, including the rental charge, of \$485.32, or an average cost of \$0.486 per yd. The rental charge and the pay of the operator and his helper were charged for 15 days to cover the period from the time the machine was loaded to ship to the job to the time it was returned.

These cranes, when fitted up with dipper arms to operate as steam shovels, have demonstrated marked economy in loading ballast where the daily require-

ments are comparatively small, since with their use it is possible to load gravel or similar material without a spotting crew. This is accomplished by locating the loading track at a sufficient distance from the face of the pit to permit the machine to work between the cars and the face of the bank. Enough cars for a day's output are placed on the loading track at any convenient time, preferably after working hours, and the shovel then loads the cars, moving forward from car to car as each is loaded. In 1926 the Burlington loaded a total of 117,708 cu. yds. of ballast in this manner from three different pits at a weighted average cost of 12.44 cents per yd. The amounts and cost per cubic yard are shown in the accompanying tabulation:

Pit	Yardage Loaded	Cost per cu. yd.
A	53,237	\$0.1000
B	49,884	0.1679
C	14,587	0.6840
Total	117,708	\$0.1244 av. cost

The difference in cost at the different pits was due largely to the characteristics of the material handled.

As an indication of the diversity of operations which these cranes are called upon to perform on this road, one of them, on a relocation and double tracking project near Alma, Wis., has been converted into a pile driver by swinging a pair of leads from the boom, using a 2,500-lb. drop hammer operated by the crane hoist, for the purpose of driving 30-ft. steel sheet piling for two cofferdams for bridge piers. After the piles had been driven 10 ft., the leads were detached and a clam shell bucket attached to excavate the material in the cofferdam to the bottom of the sheet piles. The leads will then be replaced and the driving and excavation carried on in successive stages until the cofferdams are finished, after which the crane will be equipped with a drag line bucket to excavate a change of channel for the stream.

Concrete Slab Highway Crossing

TO PROVIDE a highway crossing which would obviate the objections to plank, Permanent Concrete Products, Inc., Greenville, Ohio, has designed a crossing composed of concrete slabs, which has been installed on a number of railroads where they are said to have given satisfactory service. The slabs are 6 ft. long by 16¼ in. wide and either 5 or 6 in. thick, weighing 500 or 600 lb., respectively. They are reinforced with 10 ¼-in. twisted longitudinal bars spaced uniformly one inch from the top and bottom surfaces, and 10 ¼-in. transverse bars, spaced 12 in. center to center. The concrete is made of carefully selected and graded materials and is designed for a strength of 4,000 lb. at 28 days. The upper part of each slab is encased in an armor, consisting of a 2½-in. channel bar with a web thickness of ⅝ in., to prevent cracking. Five lines of slabs are used for each track, three lines between the rails and one line on the outer side of each rail. The outer ends of the end slabs are beveled to prevent their being displaced by dragging equipment.

The slabs are not spiked to the ties, but endwise movement is prevented by driving a spike in the tie at the outer end of each outer slab. Where this is not practicable, as in the case of diagonal crossings, a beveled timber may be spiked to the ties and the space between the timber and the ends of the slabs filled with bituminous or other material.

An installation of this type of crossing was made recently by the Cleveland, Cincinnati, Chicago &

St. Louis at Galion, Ohio, where the Harding Highway East crosses the two main tracks, the lead to Galion yards and a stock track. In this installation considerable work was done on the tracks prior to the placing of the slabs to insure proper surface and drainage. This work involved the removal of the old plank, the cleaning out of the old ballast and the placing of drain tile under and alongside the tracks, the trenches being filled with clean broken stone after the pipe was laid. After this was completed the old ties were removed and replaced with sawed treated ties, spaced 18 in. center to center to provide a smooth bed for the slabs, following which the ties were tamped and the spaces between the ties filled with clean ballast.

A roadway 60 ft. wide was provided, this requiring 50 slabs for each track, or a total of 200 slabs. The slabs were placed so that their centers rested on the center of a tie and oak flangeway fillers were



Concrete Slab Crossing on Big Four at Galion, Ohio

placed on each side of each rail, these serving to minimize the transmission of vibration from the rail, although other types of fillers may be used if desired. The spaces between the tracks were filled with stone and screenings, finished with a wearing surface of Kentucky Rock Asphalt. The crossing was closed to highway traffic while the installation was being made and, with the co-operation of the city, repairs were made to any defective curb or pavement adjacent to the crossing.

The cost of this installation was as follows:

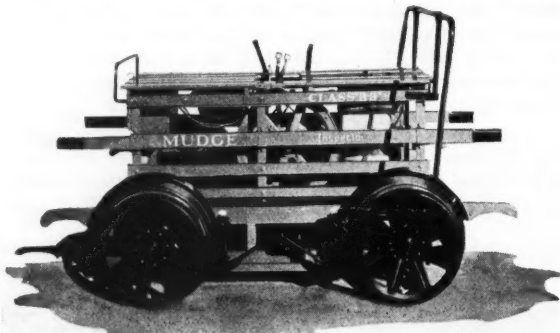
Approach and curb repairs.....	\$ 320
Drainage	270
Trackwork	930
Slabs	1,660
Kentucky Rock Asphalt.....	155
	\$3,335

As will be seen, the first cost of an installation of this type is high, but it is pointed out that much of the expense is for work which should be done with any type of crossing to insure proper track conditions as well as crossings suitable for the heavy traffic passing over them. It is emphasized further that the full cost of a crossing depends not alone on the expenditure for installing it, but rather upon the cost of maintenance and the frequency with which it must be renewed. A concrete slab crossing installed three years ago by the Big Four at Wood street, Cincinnati, Ohio, is still giving satisfactory service, where wooden plank crossings never lasted more than a year.

These crossings are also in service on the Pennsylvania, the New York Central Lines West of Buffalo, the Michigan Central, the Baltimore & Ohio, the Grand Trunk, the Chesapeake & Ohio and the New York, Chicago & St. Louis.

The New Mudge "B-3 Inspector" Motor Car

A NEW center-load inspection car, known as the Class B-3 Inspector, has been placed on the market by Mudge & Co., Chicago. While designed especially as an inspection car which can be handled by one man, if necessary, it has sufficient power, seating capacity and deck space to carry four men



A One-Man Car Which Will Carry Four

with their tools or baggage, thus making it available for division engineers, supervisors and roadmasters who require a car for engineering parties or small inspection parties in all-day service.

The new car is similar in general design and equipment to previous Mudge cars. It is equipped with a four-horsepower, free-running, water-cooled engine fitted with an Imperial primer for easy starting. Its transmission is a multiple disc clutch with



The "B-3 Inspector" Is Equipped With a Windshield

a roller chain drive to a sprocket on the rear axle. The frame embodies the Mudge tilting seat top, providing quick access to all parts of the engine. The wheel base is 37 in., the total weight, 550 lb., and the lifting weight 175 lb.

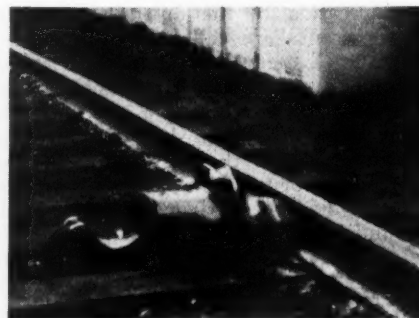
One of the new developments for this car is the Mudge windshield which consists of a strong steel pipe frame, covered with brown waterproof canvas

over the lower portion and framing an amber-colored celluloid window of ample size to permit clear vision. This windshield is attached to the safety railing, is light in weight and is quickly and easily attached. It offers a high degree of comfort to the operators of the car in cold weather without introducing the hazard of accident. This windshield may also be applied to the Mudge C-1 Centerlight car.

New Self-Adjusting Sliding Type Derail

THE Q & C Company, New York, is just announcing a new self-adjusting, sliding type derail, which involves several new details in derail construction. This new derail, which consists of two parts, the block and the housing, is of malleable iron, and of such construction that the blocks and housings are interchangeable.

One of the important features of the derail is that it will fit all rail sections from $4\frac{3}{4}$ in. to 7 in. in



The New Derail Will Fit All Rail Sections From $4\frac{3}{4}$ In. to 7 In. High

height, and is self-adjusting to the height of rail with which it is used. This feature makes possible a single derail for all sections of rail in common use, and thereby simplifies the purchasing and handling of derails, as well as derail maintenance.

The new derail, which is made in the right-hand, left-hand, or double-throw types, is equipped with two base plates, cast integral with the housing, which extend under the running rail, replacing the tie plates. This construction not only affords a firmer installation, and insures a perfectly aligned block, but also eliminates the necessity for rail braces.

In its makeup, the housing, which is of stream-line design to preclude the catching of dragging equipment, is fitted with trunnionways which form guides for trunnions on the derailing block in moving the block from the open to the closed position, or vice versa. Owing to the special design of the trunnionways, the block is carried vertically, and laterally with respect to the track, to a point at the maximum height of its movement, directly over the head of the rail. From this point it settles vertically into position on to the head of the rail. Once in place it is locked automatically, so that it cannot be lifted except through the operation of the derail stand. Similarly, the derail locks automatically in the open position. Through its self-adjusting feature, which is entirely from above, the new derail is adapted to the various sections of rail without any adzing or shimming of the ties.

The derail is designed for use with standard

screw jaw and rod connections in all interlocking and operating stand installations, and therefore can be used with standard connections now in use. Where operating stands are not in use, the derail can be thrown by hand, and provision is made for locking it with a standard switch lock in both the open and closed positions.

Paper Cement Bags Show Advantages on Railroad Work

PAPER bags made by the Bates Valve Bag Corporation, Chicago, were given a thorough service test in the construction of a new freight terminal for the Baltimore & Ohio Chicago Terminal at Seventy-Sixth street and Oakley avenue, Chicago. All the cement used on this project, 32 carloads in all, was delivered in Bates "multiwall" bags. The work was done by the Drumm Construction Company, Chicago, under the supervision of the engineering department of the railroad.

These bags are made from a tough, pliable paper tubing which consists of five separate tubes, one inside of the other, making a five-ply construction.



Cement in Paper Bags Piled High to Make a Floor Test

In the manufacture of the bags these tubes are cut into lengths and closed at each end by a lap of paper which is side-stitched into place. The cement is introduced through a self-closing valve so that there is no opening through which it can escape after the bag has been filled.

Unlike the cloth bags, the paper bags are not returnable to the mill. Therefore there is no refund of the cost of the paper bags such as is made by the cement manufacturer for cloth bags returned in good condition. However, it is claimed that the additional cost of the paper bag is offset by the lowered labor cost of handling cement on the job and by certain other advantages. These advantages, which have been confirmed in large part by the experience of the Baltimore & Ohio Chicago Terminal, are discussed briefly below:

The user of paper bags saves the expense of the labor to salvage, bale and ship cloth bags back to the cement mill, as well as the accounting which this involves. The paper container also empties cleaner and can be handled without the loss of cement or disorder caused by cement sifting through the walls of the container. The paper bag is opened quickly, either by tearing off the binding strip at one end, or by cutting into it with a shovel.

Further claims made for the paper bags are that they are strong and will resist rough handling and that they provide better protection from the weather than the cloth container. This does not mean that the manufacturer recommends any deviation from accepted practices in storing cement to insure against damage from rain, but that the paper bag provides better protection from moisture in the atmosphere during long periods of storage and also that it will not soak through as quickly as a cloth bag when subjected to a sudden shower. In this connection, attention is directed to the fact that the use of paper bags obviates the need of protection for the cement bags to insure against wetting while being delivered to the mixer or after they have been emptied, which is so necessary with cloth sacks to avoid the losses incident to the refusal of cement mills to accept returned bags that have been wet either before or after having been emptied.

The Jordan Track Oiler and Spraying Machine

THE JORDAN self-propelled track oiler and spraying machine is a new development by the O. F. Jordan Company, East Chicago, Ind., which has been designed for oiling rails in track, together with the track fastenings and other metal accessories, and also for spraying the roadbed with oil or chemicals for the purpose of keeping down the dust, or with weed killing preparations. This machine has been introduced during the last year on a number of the larger railways of the country where it is said to have effected marked economies.

In oiling rails and fastenings out of face, heated oil is discharged through nozzles on each side of each rail at pressures ranging from 80 to 100 lb. by means of a rotary pump driven from the power takeoff of the engine by gears and a silent chain. The amount of oil used can be controlled by the operator, the excess being by-passed through a pressure regulation valve. The nozzles are set near the head of the rail at such an angle that some of the oil is applied to the intersection of the top of the angle bar and the web of the rail, so that a considerable portion of it works in back of the angle bar. This work is accomplished at the rate of about 13 miles an hour and requires from 90 to 110 gal. of oil per mile, depending mainly on the size of the rail, with costs varying from \$5.50 to \$7 a mile. The cost of oiling turnouts, crossings and crossovers naturally varies with the size of the devices and the amount of oil applied. The average time for oiling a main line crossover completely is about four minutes and the cost is about \$0.55.

This method, using a light application of oil, may also be employed for removing the mill scale from new rails and loosening and removing old scale from rails subjected to brine drippings or salt spray, the oil working under the scale on account of the wave motion of the rail and loosening it so that it drops off. On one road using the machine for this purpose on a track subjected to heavy brine drippings, scales of rust 2 ft. long, 4 in. wide and $\frac{1}{8}$ in. thick dropped off within 10 days after the application of the oil. For this use, 65 to 75 gal. of oil are required per mile, and the cost ranges from \$4.25 to \$5 per mile. For oiling special work such as interlocking pipe lines or other accessories away from the track, two oil-spray hand nozzles and suitable lengths of oil-

proof hose are provided, the amount of oil applied being under the control of the operator.

If desired, the oil may be applied only to the rail joints automatically at a speed of about eight miles an hour. To provide for this an arm, supporting a guide wheel which rides against the side of the head of the rail, is fitted with a rod or "finger" which extends under the head of the rail and is held forward by a spring. When the "finger" strikes the end of an angle bar, it is forced backward against a contact block and completes an electric circuit which opens the nozzle valve to permit the discharge of oil. After the finger has passed the angle bar it is forced away from the contact block by the pressure of the spring, causing the valve to close. When oiling



The Jordan Track Oiling and Spraying Machine on the Santa Fe

rails out of face, the contact arm is raised and locked in an upright position. Railways are oiling the joints on from 45 to 60 miles of track a day with this machine, depending on traffic conditions, at costs ranging from \$0.92 to \$1.25 per mile.

For oiling the roadbed to keep down the dust, perforated pipe sprays are arranged on the front end of the car. These pipes can be extended to a distance of 7 ft. from the center line of the track, permitting an application to the width of 14 ft. or sufficient to cover the track and ballast, although longer pipes may be furnished if desired. Oiling of the roadbed is accomplished at the rate of eight miles an hour for each coat of oil applied and experience has shown that three light coats at daily intervals is the most efficient method for the first oiling, after which one application may be made annually. The amount of oil required is approximately 60 gal. per mile per foot of width of roadbed for the first year's application and 30 gal. per mile for each succeeding annual application. The cost averages \$3.50 per mile per foot of width the first year and \$1.90 per mile for succeeding years.

The spraying of the roadbed with chemical and weed killers or with liquid calcium chloride for laying dust is performed in the same manner as oiling the roadbed. The cost of this work varies to such an extent that no definite average cost can readily be given.

The machine is self-propelled by a 72-hp., 4-cylinder, heavy-duty gasoline engine. The drive and brakes operate on all four wheels, giving the maximum amount of traction. The transmission of the power is through a four-speed, selective gear type with dry-disc clutch having special long-wearing facings and extra heavy springs. The transmission is connected to a special reverse gear, enclosed and running in oil, by means of a heavy-duty, all-metal, flexible coupling. From the reverse gear, heavy

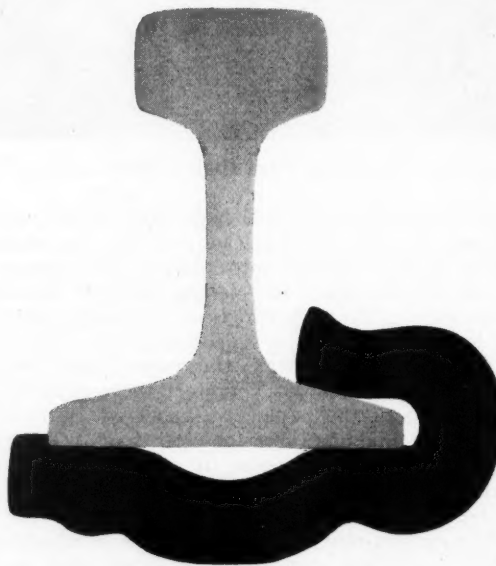
double roller chains transmit the power to each axle and speeds up to 28 miles an hour may be attained in either direction. Roller bearings are of heavy-duty type, with hardened steel thrust collars, all enclosed and running in special roller grease.

The machine is equipped with all necessary appliances and accessories for safe and convenient operation, including Westinghouse straight and automatic air brakes, draw-bars to fit standard M. C. B. couplers, standard marker brackets, electric headlight, air whistle, electric starting and lighting equipment, tools and jacks, Stewart vacuum fuel supply system, oil heaters, and all minor miscellaneous devices, the absence of which retards efficient operation. All parts subject to vibration are cushioned with the best quality of rubber.

Eight hundred gallons of oil may be carried in the motor car tanks with an additional 2,400 gal. in its attendant trailer car, making it independent of any source of supply for a considerable time. The draw-bar pull ranges from 4,200 lb. in starting to 800 lb. at 20 miles per hour. This, together with the standard automatic air-brake equipment, permits the use of standard railway tank cars of 10,000 gal. capacity as a trailing load, where heavy oiling out of face is to be done.

The Super-Fair Anti-Creeper

THE Super-Fair anti-creeper, which has been introduced by the P. & M. Co., Chicago, has been designed to furnish a simple, heavy, one-piece rail anchor to arrest severe creeping at low cost, and which may be easily applied, taken off and re-applied. The anchor is similar to the modified Fair anchor



The Super-Fair Rail Anchor

made by the same company, but is of heavier construction, being 1 in. thick, with a width of 1½ in. on the face, thus not only providing greater strength but also affording a greater bearing area against the tie. These anti-creeper anchors are said to be demonstrating their effectiveness on a number of the large railways of the country where strength and durability are required to meet severe creeping conditions.

In the manufacture of this anchor the steel is

heated in a continuous automatic furnace and then is formed in special machines, after which the anchors are quenched with oil by mechanical means and heat treated in a special automatic furnace.

Light Center-Load Inspection Car

FAIRMONT Railway Motors, Inc., Fairmont, Minn., has introduced a new center-load inspection car weighing only 395 lb., which it has designated as MM9 and which can be handled easily and safely by one man. The car is equipped with extension lifting levers which are said to reduce the lifting effort for either end of the car to 120 lb. Despite its light weight the car is sturdily built and will carry two men, together with small tools, if desired, thus making the car adaptable for a variety



New Fairmont MM9 Light Inspection Car

of uses. The center of gravity is low, the driver's seat being only 21 in. above the rail.

The frame of the car is built up of steel members, so arranged that the cross members act as rail skids in case of derailment. The wheel base is 37 in. and wood filled wheels are used, making further insulation unnecessary. The hubs are malleable iron and the axle end nuts are drilled three ways for the cotter keys, permitting adjustments to one-sixth of a turn. The axles, which are of heat treated Nikrome steel, are 1 1/4 in. in diameter, and are equipped with roller bearings running in hardened steel inner and outer sleeves which prevent cutting of the axles.

Power is supplied by a Fairmont four-horsepower, reversible, ball-bearing engine, nearly all parts of which are interchangeable with those of the standard Fairmont four-horsepower engine. The fuel tank has a capacity of two gallons, and the water jacket, which is said to require only 11 pints of water, is so designed that it cannot be injured by freezing, thus obviating the necessity of using an anti-freeze solution in cold weather. A condenser, mounted above the water jacket, returns the condensed vapor to the cooling tank, so that little water is lost by evaporation. The engine is free-running and can be started in either direction by a starting crank. The carburetor is of a simplified high efficiency type, equipped with a choke and needle valve brought up to the top of the seat for quick and convenient starting. A high tension Bosch magneto is used. Battery ignition can be furnished if desired, but its use adds five pounds to the weight of the car.

Transmission is by means of a belt drive operating above the deck of the car over large pulleys, the

speed reduction being effected by a set of hardened gears running in oil on the rear axle. The drive pulley is located to the inside of the flywheel, thus necessitating only two bearings to support the crankshaft, one on each side of the crank, large ball bearings being used for this purpose. The transmission belt is kept in tension by a Hyatt idler pulley, pivoted to the gear housing, which is controlled by means of a lever. The belt tension is released by pushing the lever forward, and when pushed farther forward the same lever applies the brakes to all four wheels, in which position it may be latched to hold the car while the engine is idling. Throttle control permits the maintenance of speeds ranging from 3 to 25 miles an hour, and since the engine is free running, the car can be stopped without any need of killing the engine.

The frame for the seat is made of pipe, braced with 1/2-in. tubing, and forms a housing for the engine. The housing can be removed quickly by loosening eight bolts, thus permitting access to the entire power plant. Pipe rails are provided at each end of the seat as a safety measure and also to prevent more than two men occupying the seat and thus overloading the center of the car.

A Combination Motor Car, Rail Layer and Electric Power Plant

A GAS-ELECTRIC car which can be used interchangeably as a motor car for transporting track or bridge gangs to or from their work, or for hauling and distributing material, as a rail laying crane and as a power plant for furnishing current for various electric tools has been developed by the Syntron Company, Pittsburgh, Pa., in conjunction with engineers of the Pennsylvania and the Westinghouse Electric & Manufacturing Company, Pittsburgh.

The car frame is built of structural steel members and carries a 24-hp. 4-cylinder gasoline engine, direct-connected to a 10-k. v. a., 110-volt, 25-cycle, 3-phase electric generator. The engine is water-cooled and is equipped with an automatic governor and force feed lubrication. The car is driven by a five-horse-

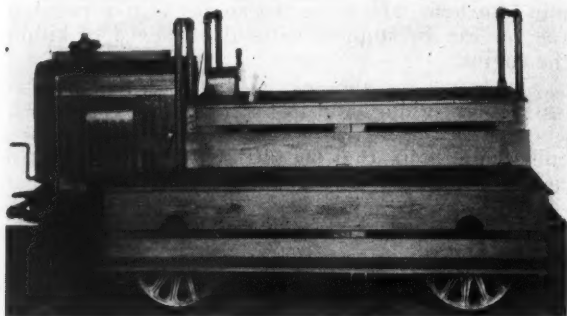


Arrangement of Generator and Motor

power, squirrel cage induction motor with a chain drive to the rear axle, the speed and power being regulated by the throttle of the engine, while the forward and reverse motions are controlled by a two-way switch. When the car is running full speed ahead, the throwing of the control switch into reverse will cause the induction motor to act as an electric brake, bringing the car to a stop, after which the motor will reverse and build up into full speed, if desired. The car is also equipped with hand-oper-

ated brakes acting on all four wheels. The maximum speed is 25 miles an hour and it is said that this speed can be maintained up a two-per cent grade, loaded with men and tools and hauling several loaded trailers. The weight of the car, fully equipped with seat and hand rails is 1,800 lb.

The deck of the car is hinged and forms covers for the tool trays, thus keeping the tools entirely out of the way of the men riding on the car and contributing to safety, not only on this account, but also by preventing the tools from falling off the car. The car will accommodate 10 men comfortably but more



The Syntron Motor Car and Power Plant

can be carried in an emergency. When the car is equipped with a boom for use as a crane it can be furnished with transverse wheels for setting it off the track between stations, if desired, but these are not necessary when it is used only as a motor car or power plant.

The Syntron Company has also developed a number of accessories and electric tools for these cars in addition to its electric tampers, thus giving the car a wide range of use. The engine and generator are the same as are used in the portable unit which the company has developed for its six-tamper outfits, permitting the tools to be used interchangeably with either. The tools include bolting wrenches for rail; spike drivers; rail and bond drills as well as steel and wood drills; electric hammers and riveters; electric welders and grinders and centrifugal pumps. A detachable boom, 22 ft. long, can also be supplied for converting the car into a rail crane, provision being made in the frame so that the boom may be attached or detached. This boom is equipped with an electric hoist which can be controlled either by the man at the rail hook or by the operator on the car, as may be desired.

The spike driver is similar in design to the Syntron tamper but is considerably more powerful. It strikes 25 blows to the second, driving the spikes quickly into the ties and eliminating the danger of flying spikes or the possibility of striking the rail. The spike drivers can be operated from the power plant.

The drills include sizes from $\frac{1}{4}$ in. to $1\frac{1}{4}$ in. for steel and up to 2 in. for wood. The wearing parts are made of high grade alloy steel and all rotating parts run on ball bearings. A rail clamp and carriage with a force feed device has been designed for the $1\frac{1}{4}$ in. drill to adapt it for use as a rail or bond drill.

A 200-amp. arc welder has also been designed for building up battered rail joints or frogs or for structural welding. Two types of electric grinders or chipping hammers may be furnished with the welder

for smoothing up the work after the welds have been made.

Electric hammers can be supplied in four classes as follows:

1. Chipping and scaling hammer, weighing nine pounds.
2. Riveting hammers, for hot rivets up to and including $\frac{3}{8}$ in. diameter.
3. Concrete and rock drilling hammers with capacities up to two inches. These hammers are similar in principle to the electric tie tamper.
4. Paving busters of light to medium capacities.

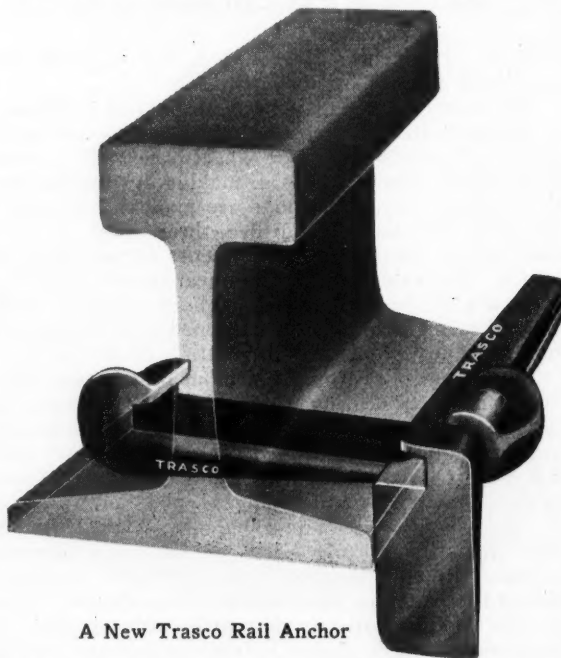
The company is also prepared to furnish centrifugal pumps, driven by an induction motor, with capacities ranging from 5 gal. per min. at 25-ft. head to 120 gal. per min. at the same head, for the purpose of unwatering excavations in connection with maintenance work.

In addition to furnishing power for the tools mentioned, the power plant may also be used to furnish current for electric lights in tunnels or for night work where artificial light is necessary.

A New Rail Anti-Creeper

THE TRACK Specialties Company, New York, has developed a new rail anti-creeping device known as the Trasco wedge anchor. This anchor consists of two parts, a yoke which extends under the rail base, and a wedge which is driven between one end of the yoke and the rail flange. Both parts of this anchor are made of malleable iron, and are of heavy, sturdy design.

The yoke of the anchor is a simple strap-like unit



A New Trasco Rail Anchor

with a hook at each end, and a vertical rib diagonally across its base and at the ends to give it increased strength. The wedge of the anchor is a right angle unit with a broad heel for bearing against the tie, and a section split horizontally to form the wedging area. This wedge is made sufficiently long to provide for considerable take-up, and to make the anchor adaptable for varying widths in the rail base.

In applying the anchor, a light hammer is the only

tool required. The wedge is fixed on the edge of the rail base with its heel against the tie, and the yoke is then driven back tightly over it. After the anchor is in place, the split in the wedge is spread slightly with a spike point or a track chisel in order to give the anchor greater holding power and to prevent it from coming apart. The new anchor has been designed so that the friction between the wedge and the rail is about four times as great as between the wedge and the yoke, a feature which causes the wedge to follow the creeping rail and therefore tighten itself in the yoke automatically.

New Spring Washer for Track Bolts

THE GEM Lock Washer Company, Detroit, Mich., has introduced a spring washer of new design for track bolts, the body having a generally rectangular form with a curved projection on each side which bears against the angle bar in such a way as to bring spring action into play when the bolt is tightened. This device is made of heat treated silica manganese steel and it is said that while the washer



The Gem Spring Washer

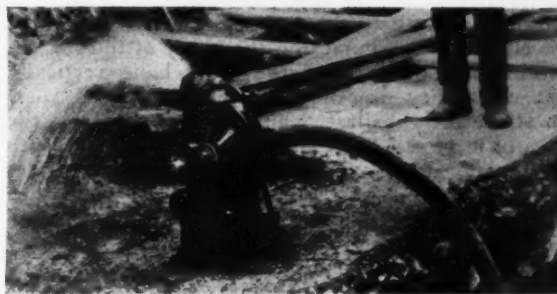
can be flattened at the center by a load of 25,000 lb. it was impossible to apply enough pressure with the testing machine to flatten the ends. It was also said that when the pressure was released the washer returned to a contour practically the same as before the pressure was applied.

These washers have been in service for 10 months and it is said that in no instance has it been necessary to tighten the bolts since the washers were applied. It is reported further that washers removed after six months use showed negligible loss in resiliency.

Small Portable Centrifugal Pump

A PORTABLE centrifugal pumping unit with a capacity of 7,500 gal. per hour and weighing only 95 lbs., has been developed by the Homelite Corporation, Port Chester, N. Y., for a wide variety of unwatering and pumping work. This pumping unit, which is known as the Homelite portable centrifugal pump, consists of the pump itself, with a bronze, open-type impeller, direct connected to a 1½-hp., single-cylinder motor operated by either gasoline or kerosene.

The suction and discharge openings of the pump are each two inches in diameter. It is claimed that the unit has a lift of 20 ft. and will operate under a head of 45 ft., handling muddy or gritty water, oils, chemicals or anything which will pass through its foot valve strainer. The motor forming a part of the unit is air-cooled and it is fitted with a Bosch high-tension damp-proof magneto.



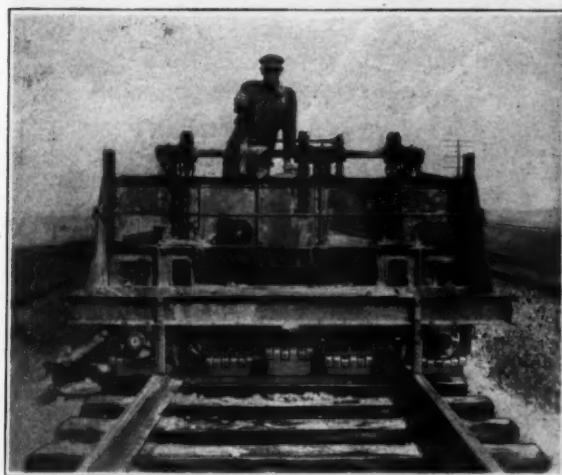
The Homelite Portable Pump Unwatering a Trench

As assembled, the pump and motor are mounted on the same base and are connected by a single shaft which runs on oversize ball bearings. The base of the unit also acts as a fuel tank and holds one gallon of fuel, sufficient to operate the driving motor for four to five hours. Spring feet have been provided on the base to absorb vibration.

The Jackson Power Ballaster

THE Jackson power ballaster, which was developed and placed on the market by the Maintenance Equipment Company, Chicago, somewhat more than a year ago, has been used extensively during the last season on the Atchison, Topeka & Santa Fe, where five of these machines are now in service. The total cost of ballasting by the machines on this road is said to have been considerably less than that for similar work done by hand, owing to the more solid and uniform tamping secured by the machine, which made a marked reduction in the amount of follow up "spotting" necessary.

The tamping is accomplished by heavy hinged steel tamping shoes attached to the lower part of a



The Jackson Power Ballaster Tamps the Entire Length of the Tie in One Operation

heavy cross head extending across the track for the full length of the ties and mounted on a steel car body which carries the power plant and operating mechanism. The shoes are placed back to back and are curved away from each other slightly, one pair operating between the ends of the ties outside each rail and three pairs between the rails. The cross head, which may be varied from 1,200 lb. to 2,000 lb. in weight, is raised and allowed to drop

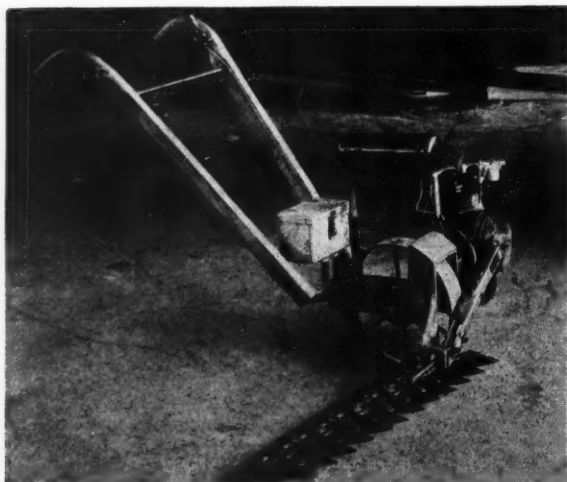
alternately at the rate of about 30 times a minute, traveling through guides on the frame of the car. As the cross head is raised the shoes hang vertically but when they descend they tend to spread apart on striking the ballast, which naturally follows the lines of least resistance or toward the voids beneath the untamped ties. The ballast is thus driven under the full lengths of two adjacent ties at the same time. When the tie is completely tamped the blows compact the ballast between the ties and in this way prevent the tamped ballast from working out from under the ties. As the tamping is completed in each crib the machine is moved forward to the next crib, this operation requiring about five seconds.

Power is supplied by a 16-horsepower Ford motor running at 1,250 r. p. m. The machine is self-propelled in either direction at speeds of from 8 to 12 miles an hour. Transverse wheels are fitted to the lower part of the frame to permit the car to be set off the track between stations. Only one man, the operator, is required on the car, and the ballasting gang is made up in the usual manner, except that no hand tampers are used other than at the jacks where the track is raised to the proper grade. The machine is said to tamp the track at the rate of from 300 to 400 ft. an hour.

A Motor-Driven Mower for Cutting Right-of-Way

THE RAWLS Manufacturing Company, Streator, Ill., has brought out a motor-driven, ball-bearing mower for cutting right-of-way which is designed to operate at a speed as fast as a man can walk, thus relieving the operator of all work except guiding the machine and insuring economy in the work.

The mower, which is designated as Type J, con-



The Rawls Motor-Driven Mower

sists of a 1½-h.p., 4-cycle gasoline engine mounted on a frame which is carried on a wide tired steel wheel running on ball bearings, a pair of handles, similar to plow handles, being attached to the frame for guiding the mower. The cutter bar is a heavy-duty McCormick sickle, three feet long, equipped with a guard and driven from the engine power take-off. The engine drives the propelling wheel through gears and the speed is regulated by a throttle controlled by a lever mounted on one of

the handles. The machine can be tilted to cut either up or down on slopes. The gasoline consumption is about 1½ gal. a day. The mower, fully equipped with gasoline tank and tool box, weighs 175 lb.

Changes in Fairmont Weed Burner

THE design of the Fairmont Weed Burner, which was developed by the Fairmont Railway Motors, Inc., and described in detail in the March, 1927, issue of *Railway Engineering and Maintenance* has since been changed by arranging the burners in six sections, with provisions for shutting off such burners



A Fairmont Weed Burner on the Tennessee Central

as may not be needed where the vegetation is irregular and covers only parts of the track or roadbed adjacent to the track. This arrangement, with the ability to burn a width of 16 ft., or 5½ ft. outside of each rail, permits the eradication of all the weeds on the track or shoulder of the ballast with a minimum of oil and thus further increases the savings made in this work.

Weed Killer Equipment Sprays Three Tracks

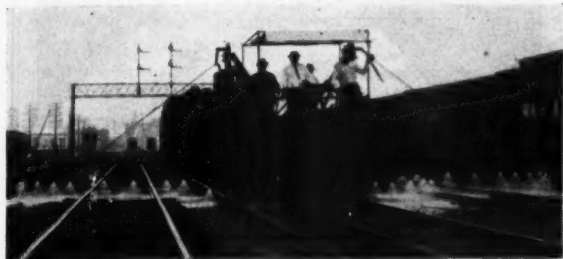
THE READE Manufacturing Company, Jersey City, N. J., has been able to effect marked economies in the killing of weeds by the poison spray method through the use of equipment that is designed to treat two and three tracks at a time. This device was used extensively last year with success.

The new equipment comprises an extension of the single-track apparatus installed on the front end of a flat car. The chemical carried in tank cars behind this car is delivered under proper pressure through the nozzles, causing it to form a very fine spray or mist, thus effectively coating the vegetation with the poisonous solution. An independent pipe of sufficient length to reach over the full roadbed width of a second track is suspended in a horizontal position from the side of the car, with suitable supports and flexible connections so that it may be swung out at right angles to the track. It is provided with nozzles that are controlled independently from the controls for the nozzles on the spray system for treating the track on which the car is operated.

The extension is supported in such a way that it is free to swing about a vertical pivot. Consequently it must be held in the open position across the second track against the wind pressure which tends to swing it back against the side of the car. This is done by the operator with the aid of a lever. This insures the rapid clearing of the second track for trains. As

soon as the boom strikes the side of the car, it is gripped by a safety lock which prevents it from rebounding.

The outer end of the boom is designed so that it can be quickly and easily raised and lowered to avoid cattle guards, switch stands, signal posts, etc. As soon as this outer extension is raised, all of the nozzles on this extension are automatically closed,

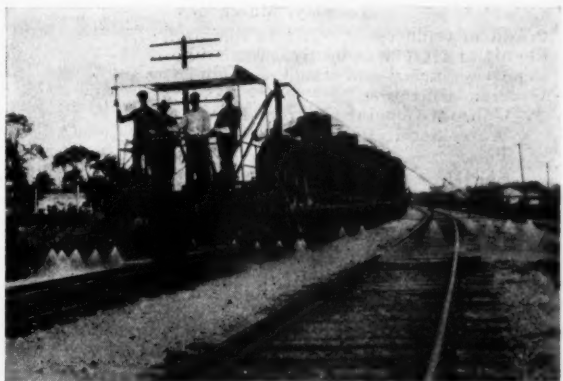


Three-Track Equipment Reduces the Cost of Spraying in Yards

without interfering with the operation of the balance of the nozzles on the boom.

Another feature which has been worked out with considerable ingenuity is an arrangement to adjust the boom for the superelevation of the rail when the work train is going around a curve. By this means the elevation of the nozzles above the second track can be maintained with the same accuracy as on standard single-track equipment.

The use of the second-track extension effects a marked saving in operating costs. From 75 to 100 miles of treatment a day can be made with the standard single-track outfit, and this of course, can be



Spraying Double Track with One Movement of the Weed-Killer Train

doubled with the use of the double-track outfit, thereby reducing the cost of train service per mile of single track by substantially 50 per cent.

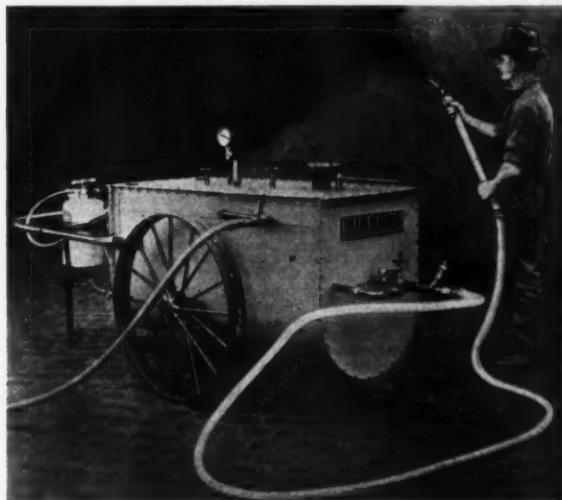
On one road where the Reade Manufacturing Company was treating an extended mileage of both single and double main line last summer, an extension boom was placed on each side of the application car in addition to the standard single-track equipment. It was thus possible to spray three tracks with one movement of the work train, thereby greatly reducing the cost of train service in treating multiple tracks, passing tracks and large yards. For example, in covering several hundred miles of single track line with this outfit, every passing track, regardless of the side of

the main line on which it was located, was treated without stopping the train to enter the passing track or backing up the length of the passing track in order to cover the additional trackage. This, of course, greatly increased the mileage that it was possible to treat in a day.

A New Bitumen Spray Gun

A NEW spray gun, known as the Quigley bitumen gun, carries the "spray" idea of applying liquids into an entirely new field. This gun is designed especially for applying bituminous materials as protective coatings for foundations, walls, roofs, concrete bridge decks, etc., and is said to effect large economies through its use.

The new gun, which is manufactured by the Quigley Furnace Specialties Co., Inc., New York, is an adaptation of the Quigley refractory gun, which is



Waterproofing a Concrete Wall with the New Gun

used for shooting plastic refractories or concrete mixtures. The bitumen gun, which is enclosed in a steel housing mounted on wheels, consists of a cast iron cylinder from which the material is forced by a piston. The capacity of the gun is 15 gallons, or enough to cover approximately 400 square feet of surface in waterproofing work. Fifteen cubic feet of air per minute at 60 lb. pressure is sufficient to operate the gun, a small portable compressor being suitable for this purpose where no other air supply is available.

In the operation of the gun, compressed air is never in contact with the spray material, nor is it used to form the spray. Atomization is obtained by a purely mechanical process. Through this arrangement, air is not entrapped in the material, which retains all of its original properties required for proper penetration and adhesion to the surface to which it is to be applied.

Two unskilled men can operate the gun after a few minutes of instruction, one man at the nozzle and the other charging the gun and controlling the air supply. For hot spraying, preheated material is put into the gun through a charging opening, and the air pressure is then admitted back of the piston. The temperature of the charge in the gun is always apparent through the provision of a thermometer in plain view of the operator, and this temperature can

be maintained or regulated by means of a small self-contained kerosene burner. After the gun has been completely discharged, compressed air sends the piston back to the loading position.

Long hose used with the gun gives easy access to remote places and also eliminates the necessity of moving the gun frequently. As the material is forced through the hose there is a drop in its temperature, but this does not exceed three degrees in each 25 ft. of length. The material is sprayed through a special nozzle, the end of which can be adjusted to any desired angle, so as to reach places otherwise inaccessible. When the work is completed or stopped, the gun can be drained of all unused material, and the hose cleaned out with hot compressed air. Heating of the air for cleaning purposes is accomplished by a heating coil located in the gun housing.

Many advantages are claimed for the new gun, among which are uniform coverage, good penetration and adhesion, and a large saving in time and labor. On one job, two men with the gun are said to have covered more surface than could have been covered by 12 men using mops and sprinkling cans, the gun spraying five gallons per minute and covering approximately 125 sq. ft.

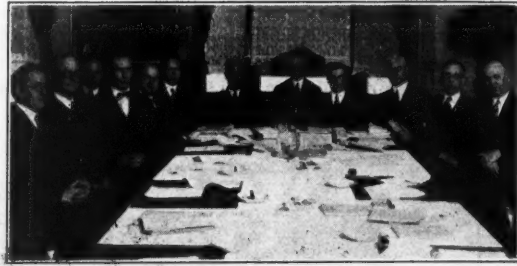
Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 23-25, 1928, Hotel Statler, Boston, Mass.
American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, March 6-8, 1928, Palmer House, Chicago.
American Wood-Preservers' Association, H. L. Dawson, secretary, 228 North La Salle street, Chicago. Next convention, January 22-24, 1929, Louisville, Ky.
Bridge and Building Supply Men's Association.—W. D. Waugh, secretary, Detroit Graphite Company, Railway Exchange Building, St. Louis, Mo. Annual exhibit at convention of American Railway Bridge and Building Association.
National Association of Railroad Tie Producers.—E. A. Morse, secretary, Potosi Tie & Lumber Company, St. Louis, Mo. Next convention, April 24-26, 1928, Arlington Hotel, Hot Springs, Ark.
National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.
Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 18-20, 1928, Book Cadillac Hotel, Detroit, Mich.
Track Supply Association.—A. H. Told, secretary, Positive Rail Anchor Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.



Pouring Concrete at 40 Deg. F. Below Zero—
Riley Creek Viaduct, Alaska Railroad

With the Associations



Roadmasters' Association

The members of the executive committee will meet for dinner at the Auditorium Hotel, Chicago, at 6:30 on Monday evening, March 5, to consider progress reports of committees.

Wood-Preservers' Association

At a meeting of the executive committee at Montreal, following the adjournment of the annual convention, H. B. Hoyt, superintendent timber preserving plant, Buffalo, Rochester & Pittsburgh, Bradford, Pa., was elected a member of the executive committee to fill the vacancy resulting from the election of C. C. Cook as second vice-president. The executive committee will hold another meeting at 10 a. m., March 7, at the University Club, Chicago.

Engineering Association

The following is the program for the twenty-ninth annual convention, which will be held at the Palmer House, Chicago, on March 6-8:

Tuesday, March 6

President's address.
Report of secretary and treasurer.
Report of special and standing committees on:
Standardization.
Uniform General Contract Forms.
Water Service.
Ties.
Ballast.
Iron and Steel Structures.
Wooden Bridges and Trestles.
Shops and Locomotive Terminals.
Rules and Organization.

Evening Session—Moving Pictures

"The Baltimore and Ohio Railroad Fair of the Iron Horse."

"The Mississippi Valley Flood of 1927."

Wednesday, March 7

Electricity.
Signals and Interlocking.
Yards and Terminals.
Economics of Railway Operation.
Economics of Railway Location.
Economics of Railway Labor.
Track.
Rail.
Annual dinner.

Thursday, March 8

Roadway.
Masonry.
Grade Crossings.
Stresses in Railroad Track.
Wood Preservation.
Records and Accounts.
Buildings.
Co-operative Relations with Universities.
Closing Business.

More than 700 reservations have already been received for the annual dinner, which will be held on the Wednesday evening of the convention week.

The Material Market

FROM the standpoint of the track departments of the railways, interest in the iron and steel industry is now more largely in production than in purchases and prices. The railroads are specifying heavily against their orders for rails and track accessories, with the result that production is now in full swing, particularly in the Chicago area, where the rail mills are now working practically to capacity. In fact, there has been a speeding up of the steel mills as a whole. Total production in the Pittsburgh region is now around 75 to 80 per cent of capacity and at Chicago about 92 per cent.

This does not mean that all of the railroads have yet placed their full requirements for rails and track fastenings. Current orders are not in large volume but totaled as much as 50,000 to 60,000 tons in at least one week during the past month. The Southern placed orders for 22,555 tons of rails, the Chicago, Rock Island & Pacific for 50,000 tons and the Canadian National for 30,000 tons, the latter order being supplemented by orders for a considerable volume of bolts, spikes, tie plates and rail anchors. Other purchases of auxiliary track materials include one by the Southern Pacific for 4,400 tons of tie plates and an order by the Wabash for 4,800 tons of tie plates.

Railroads a Factor in Structural Steel Market

The railroads are now also an important factor in the market for structural steel. Contracts awarded for a new railway and highway bridge across the Mississippi river at Vicksburg involve 16,000 tons of steel. The Big Four is expected shortly to announce the placing of a contract for the renewal of the superstructure of its bridge over the Ohio river at Louisville, which will also require a large tonnage. Early in the month

Iron and Steel Prices Per 100 Lb.

	January		February	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	\$2.80	\$2.80	\$2.70 to \$2.80	\$2.80
Track bolts	\$3.80 to 4.00	3.80	3.80 to 4.00	3.80
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.25	2.25	2.25	2.25
Boat spikes	3.10	3.10	2.90 to 3.00	2.90 to 3.00
Plain wire	2.40	2.45	2.50	2.50
Wire nails, keg	2.55	2.60	2.65	2.70
Barb wire, galv.	3.20 to 3.25	\$3.25 to 3.30	3.35	3.40
C. I. pipe, 6 in. to 12 in., ton		34.20 to 36.20		34.20 to 36.20
Plates	1.80 to 1.85	1.90 to 2.05	1.85	1.95 to 2.05
Shapes	1.80 to 1.85	1.90 to 2.05	1.85	1.95 to 2.05
Bars, soft steel	1.80 to 1.85	1.90 to 2.05	1.85	1.95 to 2.05
Rivets, struc.	2.75	2.85	2.75	2.85
Con. bars, billet	1.90 to 1.95		1.90 to 1.95	
Con. bars, rail	1.65 to 1.70	1.80	1.75	1.80
Rails per gross ton f. o. b. mills		43.00		43.00

the Cleveland Union Terminal placed orders for 57,800 tons of structural steel required in connection with the new Union station. An important project which is expected to materialize in the near future is a bridge over the Arkansas river at Little Rock, Ark., for the Missouri Pacific to replace a structure destroyed last spring.

New Prices Not Yet Fully Tested

Taken as a whole prices are not as strong as they were a month ago, although this is not manifested in published quotations. Owing to the fact that many buyers placed sizable orders prior to the last advance in structural steel prices, the volume of business at the higher rates has been limited. As a consequence the new prices have not been fully tested. This is true also of the prices of wire and wire products. The new price of nails, in particular has not been fully estab-

lished. One effect of the advance in prices has been a most complete specification by the buyers against old orders. When these have been exhausted new prices will be subjected to a real test.

The scrap market is weaker, although the Chicago prices given in the table are unchanged. A lessening

Scrap Prices Per Gross Ton at Chicago

	January	February
Relaying rail (including angle bars)	\$26.00 to \$31.00	\$26.00 to \$31.00
Rails for rerolling	15.00 to 15.50	15.00 to 15.50
Rails less than 3 ft. long	15.25 to 15.75	15.25 to 15.75
Frogs and switches cut apart	14.25 to 14.75	14.25 to 14.75
Steel angle bars	14.00 to 14.50	14.50 to 14.50

demand finds a number of railroads with offerings of considerable tonnages still on the market.

No Definite Trend in Lumber Prices

Prices of various lumber items have been subject to moderate fluctuations during the past month without furnishing any index of a definite trend. In general the markets are all more active, with the result that the orders for lumber reported by the National Lumber

Southern Pine Mill Prices

	January	February
Flooring, 1x4, B and btr., flat	\$38.00	\$37.75
Boards, 1x8, No. 1	31.50	33.25
Dimensions, 2x4, 16, No. 1, common	23.75	24.70
Dimensions, 2x10, 16, No. 1, common	25.50	25.83
Dimensions, 2x4, 16, No. 2, common	20.50	22.81
Dimensions, 2x10, 16, No. 2, common	21.00	20.60

Douglas Fir Mill Prices

	January	February
Flooring, 1x4, B and btr., flat	\$23.00	\$23.50
Boards, 1x8, No. 1	14.75	15.75
Dimensions, 2x4, 16, No. 1, common	17.25	17.50
Dimensions, 2x10, 16, No. 1, common	17.25	17.75
Dimensions, 3x3 to 4x12, No. 1, common	18.50	18.75
Dimensions, 5x5 to 12x12, No. 1, common rough	17.00	17.00

Manufacturers Association for soft woods for the first five weeks of the new year total 1,093,000 M. ft. b.m. as compared with 956,000 M. ft. b.m. for the corresponding period last year. The gain was particularly heavy for Douglas fir, the West Coast Association reporting sales totaling 25 per cent greater than a year ago. Southern Pine mills also report increased sales.

Prices quoted below for Portland cement per barrel in carload lots, not including package, are the same as those given in the table last month except that the price at San Francisco is 10 cents lower:

New York	\$2.03	Minneapolis	\$2.22
Pittsburgh	2.04	Denver	2.85
New Orleans	2.07	Dallas	2.05
Chicago	2.05	San Francisco	2.41
Cincinnati	2.23	Montreal	1.41



A Railway Bridge in Chile

Railway News



Briefly Told

The Phoenix Mutual Life Insurance Company, Hartford, Conn., has announced that because of the reduction in the number of American railway employees killed and injured during the last 10 years, the cost of life insurance for such employees has been reduced.

Only eight passengers were killed in train accidents on the railroads of the United States in the first ten months of 1927, the smallest figure on record for that length of time. The locomotives of these railroads ran 1,460,268,722 miles during this time, a slightly smaller mileage than in the same period of the preceding year.

The bridge and building department of the El Paso division of the Southern Pacific went through the year 1927 without a reportable injury. Ten different gangs were employed on this division with an aggregate of 273,768 man-hours, the man-hours for the individual gangs ranging from a minimum of 18,326 to a maximum of 49,685.

Revenue freight car loadings for the week ending February 11 totaled 906,009, a decrease of 56,593 as compared with the corresponding week in 1927 and of 11,616 as compared with the same week in 1926. The cumulative total for the first six weeks of the current year is 5,279,936, compared with 5,684,926 and 5,518,812 for the same periods in 1927 and 1926, respectively.

A resolution has been introduced in the United States Senate by Senator Copeland of New York directing the Interstate Commerce Commission to report to the Senate its opinion as to the feasibility of requiring each railway subject to the Interstate Commerce Act to establish a pension fund for its employees. If the commission finds this feasible it is directed to include in its report a statement of the plan for establishing such a fund which the commission deems most suitable.

The Cleveland, Cincinnati, Chicago & St. Louis, on January 25, ran a special train which maintained an average speed of 65.5 miles an hour, including stops, for the 514.7 miles between Granite City, Ill., and Berea, Ohio. Deducting 14 minutes consumed in taking water and changing engines, the speed averaged 67.3 miles an hour. This compares with the fastest run on record for a distance of more than 500

miles, which was also made by one of the New York Central lines on June 13, 1905, when the Lake Shore & Michigan Southern (now a part of the New York Central) ran a train of three cars from Chicago to Buffalo, N. Y., 525 miles, at the rate of 69.53 miles an hour.

The Car Service Division of the American Railway Association has made a forecast that the freight car requirements for 27 principal commodities for the first quarter of 1928 will be 8,150,871, as compared with actual loadings of 8,342,533 for the same period in 1927, a decrease of 2.3 per cent. This estimate is based on estimates and reports of trade conditions furnished by committees of the 13 shippers' advisory boards whose jurisdiction covers the United States. Increases ranging from 0.3 per cent to 13.9 per cent are indicated for 15 commodities, the latter figure applying to paper, printed matter and books, while decreases ranging from 0.9 per cent to 30.7 per cent are estimated for the remaining 12 commodities. The greatest decrease indicated is for cotton, 30.7 per cent, closely followed by cotton seed and products except oil, with an indicated decrease of 30.0 per cent.

Senator Howell, of Nebraska, on February 8, offered an amendment to the Interior Department appropriation bill, to provide that none of the appropriation for the Alaska Railroad should be used for the operation of the 39-mile narrow gage branch extending northeast of Fairbanks, which he said was being operated for the benefit of the United States Smelting, Refining & Mining Company. He said that the branch was operated at a loss and that it should be leased to the mining company for operation. Senator Willis, of Ohio, replied that a subsidiary of the mining company had just completed an investment of \$9,000,000 in that region and that the railroad expected a large increase in traffic from it. After this amendment was defeated, Senator Howell proposed another providing that none of the \$400,000 provided in the bill for capital expenditures be expended on the line between Seward and Anchorage, on the ground that it also was an unprofitable section of the line. This amendment was also defeated. In the course of the debate Senator Howell said that the govern-

ment has expended some \$60,000,000 on the road, which serves only 8,000 people in the territory for 150 miles on each side of it, of whom 3,000 are there merely because of the railroad.

Senator Brookhart, of Iowa, has introduced a bill to prevent monopoly in the production, transportation and sale of anthracite coal by providing for the acquisition by the government by lease, purchase or condemnation, of lands containing coal, leasing lands for mining and the construction or acquisition of railroads and facilities for the transportation and delivery of the coal "in order to prevent discrimination in transportation service or rates against such lessees." The bill would authorize the appointment of a Federal Coal Commission to exercise the powers proposed in the bill, including the administration of the railroads which may be acquired, charging a rate which in its judgment should be sufficient to pay an annual return of 4 per cent on the investment, plus the cost of operation, depreciation, and a sinking fund to pay for the cost in 25 years, with the further provision that no freight rate is to be charged which is higher than those charged by other railroads.

The Lehigh Valley, having agreed with the New Jersey State Highway Commission on plans for the abolition of a grade crossing, was about to begin work when the Board of Public Utility Commissioners of the state overruled the highway commissioners and called upon the road to adopt another plan costing nearly twice as much. To this the road demurred and entered suit against the public utility commissioners on the grounds that the Transportation Act of 1920, in the clause directing the Interstate Commerce Commission to make railroad rates which will or should produce a fair return, stipulates that the railroad management must be honest, efficient, etc., and "make reasonable expenditures for structures and equipment." The road contends that, in view of this clause, a state may not rightfully require expenditures in excess of what may be deemed reasonable by the federal authority, since such action would defeat the purpose of Congress to balance revenue and expenditures. The suit, which was decided against the road in the lower court, is now before the United States Supreme Court.

Construction News

The Alabama, Tennessee & Northern has announced plans for the construction of a yard, a locomotive terminal and a freight station at Mobile, Ala., following the acquisition of a 99-year lease on an 18-acre tract of land at the State docks. The yard will have a capacity of about 600 cars. Other construction will include a roundhouse, a coaling station, a freight station, team tracks, an automobile unloading platform and live stock pens. The total cost of the project is estimated at \$400,000.

The Chesapeake & Ohio has awarded a contract to Haley, Chisholm & Morris, of Charlottesville, Va., for terminal facilities at Danville, W. Va. This project is to cost \$50,000.

The Chicago & Alton has prepared plans for the construction of a passenger station at Delavan, Ill., to be used jointly with the Illinois Central. Plans are in the course of preparation for the construction of an outlying passenger station at College Avenue, Alton, Ill.

The Chicago & North Western has awarded a contract to Peppard and Burrill, Minneapolis, Minn., for the construction of the substructure of a 55-ft. steel bridge spanning a highway at Baraboo, Wis. This company plans the construction of a brick freight station and accompanying track facilities at Appleton, Wis. The main freight station will have dimensions of 40 ft. by 218 ft., with a two-story office building at one end which will have outside dimensions of 40 ft. by 40 ft.

The Chicago, Milwaukee, St. Paul & Pacific, by an amendment to the original act of Congress authorizing this company to construct a bridge over the Mississippi river at St. Paul, Minn., has been granted an extension of the time within which work must be started to February 16, 1929. By the same amendment the time within which the construction must be completed has been extended to February 16, 1931. This bridge, which it is estimated will require a total expenditure of about \$3,000,000, will be located on the Ford plant line of the Milwaukee and will be double track width to provide for future use as a through line. A contract has been let by this company to Henry Danischewsky, Milwaukee, Wis., for the construction of a brick freight station with concrete foundations in an outlying district at North avenue, Milwaukee.

The Cleveland Union Terminals will start work on May 15 on the construction of the second section of the Terminal Tower building at Public Square, Cleveland, Ohio, as a part of a contract let to John Gill & Sons, Cleveland, in February, 1926. The cost of the second unit is estimated at \$3,500,000. It will consist of a 15-story

brick, steel and concrete building with outside dimensions of 72 ft. by 120 ft.

The Denver & Rio Grande Western is receiving bids for the enlargement of three tunnels on La Veta Pass between Pueblo, Colo., and Alamosa, for the relining of the tunnel at Beaver Tail, east of Grand Junction, Colo., and for the construction of a concrete tunnel in Glenwood Canyon, Colo., to overcome trouble from mud slides.

The Great Northern has awarded a contract for the construction of foundations for an addition to the grain elevator at Superior, Wis., to the Peppard & Fulton Company, Superior, Wis., and a contract for the construction of the superstructure has been let to the Barnett & Record Co., Duluth, Minn. The addition will consist of 240 concrete tanks, each with a capacity of 12,500 bu.; 110 ft. high and 13 ft. in diameter. With the enlargement of the workhouse and the installation of additional machinery the project is expected to involve an expenditure of more than \$800,000.

The Interstate Commerce Commission, on January 27, made public its third supplemental report in the Oregon construction case, authorizing the railroads involved to put into effect arrangements for the construction and operation by the Great Northern of a line between Bend and Klamath Falls, Ore., by making use in part of existing lines, as a substitute for the plan by which the Oregon Trunk was conditionally authorized by the commission to build a line between those points. The Oregon Trunk was unwilling to accept these conditions.

The commission has now issued a certificate authorizing the Great Northern to operate over the lines of the Spokane, Portland & Seattle, the Oregon Trunk and the Deschutes, between Wishram, Wash., and Bend, Ore., 151 miles, and another authorizing it to acquire an undivided three-fourths interest in the railroad and properties of the Shevlin-Hixon Company, having a line southerly from Bend about 25 miles, to construct an extension from its terminus to Chemult, Ore., 47 miles, and to operate over the Natron Cutoff line of the Southern Pacific between Chemult and Klamath Falls.

Authority also was granted to the Great Northern to acquire control, jointly with the Southern Pacific, of the Oregon, California & Eastern, by purchase of capital stock.

The Gulf, Colorado & Santa Fe contemplates the construction of a freight station at San Angelo, Tex., for which it is planned to invite bids within about six weeks. It is also planned to construct a five-stall steel and concrete roundhouse at San Angelo.

The Louisville & Jeffersonville Bridge & Railroad Company has filed tentative plans with the United States district engineer at Louisville, Ky., for the

reconstruction of the steel superstructure and masonry other than in the river piers of the bridge over the Ohio river between Louisville and Jeffersonville, Ind., at a cost of between \$3,250,000 and \$3,500,000. This bridge and approaches are operated jointly by the Cleveland, Cincinnati, Chicago & St. Louis and the Chesapeake & Ohio.

The Minneapolis, St. Paul & Sault Ste. Marie has announced that the budget of this company for 1928 provides for the expenditure of \$800,000 for the enlargement of the Schiller Park (Chicago) yard and for the expenditure of \$200,000 for the construction of new passing and storage tracks between Stevens Point, Wis., and Chicago.

The Missouri Pacific has awarded a contract for the construction of 16.6 miles of new double track on the St. Louis-Kansas City line, between Allenton, Mo., and Labadie, involving abandonment of the old line between those two points to J. A. Kreis & Sons, Knoxville, Tenn. The total cost of the project is estimated at \$4,885,000.

The New York Central has awarded a contract to Alvord & Swift of New York for the installation of a ventilating system in the battery room of sub-station 1-B, Grand Central Terminal, New York.

The New York, Chicago & St. Louis has awarded a contract for the installation of two electric cinder handling plants at Frankfort, Ind., to Roberts & Schaefer Company, Chicago.

The Pennsylvania has awarded a contract to Sinclair & Grigg of Philadelphia, Pa., for concrete pile foundations for the proposed cold storage warehouse at the Pennsylvania Produce Terminal at Philadelphia at a cost of \$100,000.

The St. Louis-San Francisco has awarded a contract for the construction of 100-ton reinforced concrete coaling stations, at Pleasant Ridge, Ala., and at Magnolia, Ala., to the Ogle Construction Company, Chicago.

The St. Louis Southwestern plans the expenditure during 1928 of \$2,900,000 for the reconstruction of 162 miles of its lines in Texas. Included in this project is the revision of grades and alignment of the line between Mt. Pleasant, Tex., and Tyler, 67 miles, at a cost of \$1,900,000, and of the line between Sulphur Springs, Tex., and Dallas, 95 miles, at a cost of about \$1,000,000.

The Sacramento Northern has been authorized by the Interstate Commerce Commission to construct a railroad in Yolo and Solano counties, California, from a connection with the San Francisco-Sacramento at Lisbon in a southerly direction to a point at or near the southern line of Reclamation District No. 999, a distance of approximately 13 miles, and to operate under trackage rights over the railroad of the San Francisco-Sacramento between

West Sacramento and Lisbon, approximately 8 miles, in Yolo county.

The Seaboard Air Line has awarded a contract to the C. V. York Company of Raleigh, N. C., for the construction of an office building at Howells, Ga., to cost approximately \$15,000.

The Southern Pacific has awarded a contract for the construction of a machine shop at Eugene, Ore., to H. E. Wilder, Eugene. This shop, which is to be constructed of steel with corrugated metal siding, will have outside dimensions of 72 ft. by 222 ft. The cost of the building, including a 10-ton traveling crane, and other facilities, is estimated to be \$242,000.

Plans have been prepared for the construction at Fresno, Cal., of a classification yard which will have an estimated ultimate cost of about \$2,000,000. The first unit of the yard, consisting of 23 miles of tracks, an oil pump of 36,000 gal. capacity, with necessary oil-unloading facilities and air lift for automatic fuel oil servicing, a track scale of 150 tons capacity, two 65,000 gal. steel water tanks, a store building and telegraph and yard offices, will be constructed during 1928.

This company has agreed to bear \$120,000 of the cost of the construction of a highway subway under the Fresno yard at Clinton avenue, to be built in the future when public convenience and necessity require it.

The Union Pacific has awarded a contract for the grading and placing of culverts on an extension from the end of the present Platte Valley line near Creighton, Wyo., to a point on the main line near Egbert, 54 miles, to the Utah Construction Company, Ogden, Utah, at a cost of about \$700,000. Work under this contract is expected to begin before February 22. Company forces will be employed in laying track and constructing timber bridges. The entire project, which is estimated to cost about \$2,500,000, will be completed during December, 1928.

The Vicksburg Bridge & Terminal Company has awarded contracts for the construction of a combined railway and highway bridge across the Mississippi River at Vicksburg, Miss., which will be used by the Yazoo & Mississippi Valley and will when completed replace the railroad's existing ferry service between Vicksburg and Delta Point, La., to the following contractors: for construction of the sub-structure for the river spans to the United Engineers and Constructors, Inc., Philadelphia, Pa., for construction of the sub-structure for the west approach trestle, to the Virginia Bridge & Iron Company, Roanoke, Va., for grading of the embankment in the west approach, to J. A. Kries and Son, Knoxville, Tenn., for construction of the super-structure of the river spans and the east end of the bridge trestle and the super-structure of the west approach trestle, to the American Bridge Company. The cost is estimated at \$3,000,000.

Supply Trade News

Personal

Charles M. Hoffman, assistant to the vice-president of the Dearborn Chemical Company, Chicago, has been elected vice-president.

W. E. Greenwood, assistant manager of the railway traffic and sales department of the Texas Company, New York, has been promoted to manager, succeeding William Jervis, who has resigned.

George E. Ladd, economic geologist of the Bureau of Public Roads of the U. S. Department of Agriculture, has resigned to become consulting geologist of the Armo Culvert Manufacturers' Association, with headquarters at Middletown, Ohio. Mr. Ladd was



George E. Ladd

born on July 23, 1864, at Haverhill, Mass., and graduated from Harvard University in 1887, after which he continued his studies at universities in Germany. He was associated with geological surveys for the United States, Missouri and Texas from 1887 to 1892, and from the latter year to 1894 he was assistant in geology at Harvard University. He resigned in 1894 to become assistant geologist and chemist for the Georgia Geological Survey and in 1896 was appointed director and professor of geology and mining of the Oklahoma School of Mines and Metallurgy, continuing in this position until 1913 when he became president of the New Mexico College of Agriculture and Mechanical Arts. In 1917, he became economic geologist for the Bureau of Public Roads of the United States Department of Agriculture, which position he was holding at the time of his recent appointment as consulting geologist of the Armo Culvert Manufacturers' Association.

B. F. Fairless, vice-president and general manager of the Central Alloy Steel Corporation, Massillon, Ohio, has been elected president and general manager, succeeding, as president, Charles E. Stuart, resigned. Mr. Fair-

less will be succeeded as vice-president by S. S. French, president of the Berger Manufacturing division of the Central Alloy Steel Corporation, who will remain in that position.

Mr. Fairless was born on May 3, 1890, at Pigeon Run, Ohio, and was



B. F. Fairless

educated at Ohio Northern University and Wooster University. He entered railway service in 1912 as a transitman on the Wheeling & Lake Erie at Brewster, Ohio, and on May 3, 1914, became associated with one of the predecessor companies of the Central Alloy Steel Corporation.

George A. Nicol, Jr., general manager of the railroad and government departments of the Johns-Manville Corporation, New York, with headquarters in that city, has been elected a vice-president. Mr. Nicol was born in Providence, R. I., and was educated at the Rhode Island School of Design. After serving an apprenticeship with the Rhode Island Locomotive Works, he became a designer with the Ameri-



George A. Nicol, Jr.

can Locomotive Works. In March, 1904, he became a locomotive designer for the Louisville & Nashville at Louisville, Ky., and later specialized in car design. In August, 1905, he entered the service of the Baltimore & Ohio as designing engineer in the mechanical department at Baltimore, Md., remaining in that position until

January, 1909, when he became associated with the H. W. Johns-Manville Company, now the Johns-Manville Corporation, as a railroad representative. Three years later he was transferred to the executive headquarters at New York as eastern assistant manager of the railroad department and in 1920 was promoted to eastern manager of that department. In 1924, he was promoted to general manager of the railroad and government departments, which position he was holding at the time of his recent election as vice-president.

C. W. Gennet, Jr., manager of the rail department of the Robert W. Hunt Company, Chicago, has resigned to become vice-president of the newly organized Sperry Rail Service Company, Brooklyn, N. Y., with headquarters at Chicago, where he will assume direct charge of the service of this company to the railways in locating transverse fissures in rails in track. Mr. Gennet was born on August 1, 1876, at Binghamton, N. Y., and grad-



C. W. Gennet, Jr.

uated from Cornell University in 1898. After completing his college course he entered the employ of the Baldwin Locomotive Works and a year later entered the testing department of the Southern at Alexandria, Va. In 1907, he was appointed manager of the St. Louis (Mo.) office of the Robert W. Hunt Company, and in 1909 was promoted to manager of the rail department, with headquarters at Chicago, in charge of inspection of rails and fastenings, which position he was holding at the time of his resignation.

H. H. Morgan, manager of the Pittsburgh, Pa., office of the Robert W. Hunt Company, has been promoted to manager of the rail department, with headquarters at Chicago, to succeed C. W. Gennet, Jr., whose resignation to become vice-president of the Sperry Rail Service is noted elsewhere in these columns. Mr. Morgan entered the employ of the Robert W. Hunt Company in 1904, since which time he has been connected with the inspection and testing work of that organization, particularly with reference to rails and fastenings. He was in charge of the

physical testing laboratory from 1908 to 1918 and during the World War was transferred to Washington, D. C., to take charge of the work done by his company in the inspection tests of the engineering materials and equipment for the American Expeditionary



H. H. Morgan

Forces, being commissioned a captain while engaged in this work. At the close of the war, Mr. Morgan was promoted to district manager with headquarters at Pittsburgh, which position he was holding at the time of his recent promotion to manager of the rail department.

A. L. Greenabaum, general sales manager of the O. F. Jordan Company, East Chicago, Ind., has been elected vice-president of that company. Mr. Greenabaum was born on January 20, 1880, at Wilmington, N. C., and after serving in the Navy in the Spanish-American war, was employed by contractors engaged in the construction of hydro-electric plants and of locks and dams on the Ohio, Alle-



A. L. Greenabaum

gheny and Monongahela rivers. He later entered the service of the Chicago, Rock Island & Pacific, where he was supervisor of work equipment. He left the Rock Island in 1920 to become manager of the O. F. Jordan Company and later was promoted to general sales manager, which position he was holding at the time of his election as vice-president.

General

The Federal Cement Tile Company, Chicago, recently commenced the operation of a new plant for the manufacture of Federal precast concrete cribbing at Farmingdale, Long Island.

The Inland Steel Company and the **Youngstown Sheet & Tube Company** will be merged if the actions of the directors of each company approving the consolidation are confirmed by the stockholders, who will meet on March 15 to vote upon the plan.

The United Conveyor Corporation, Chicago, has purchased from the **Conveyors Corporation of America** the good will and all patents, designs, patterns and manufacturing rights for the **American Steam Jet Ash Conveyor**, the **American Cast Iron Storage Tank**, **American Air Tight Doors** and the **Steam Jet Ash Conveyor** business of its predecessors, the **American Steam Conveyor Corporation**, the **Green Engineering Company**, the **Girtanner-Davies Company** and the **Griffin Engineering Company**.

Trade Publications

Owen Buckets K and M.—The **Owen Bucket Company**, Cleveland, Ohio, has issued two folders, one describing the new type K handling bucket and the other the type M digging bucket, new models which were recently introduced by that company. Full details of the buckets are given and the folders are copiously illustrated with views of the devices in operation as well as with line drawings of the various parts.

Side Cut, Non-Skim Coaling Gate.—The **Roberts & Schaefer Company**, Chicago, has issued a four-page circular describing and illustrating its side cut coaling gate, which is designed to prevent the clogging of coal at the opening and also to permit the coal to pass from the bin to the tender without segregation, while the flow of coal can be regulated to suit the requirements of each locomotive. The gate is hooded and is swiveled to permit a spread over the tender without spotting the locomotive.

Bonanza Cementile Roofing.—An attractive and informative general catalog has been issued by the **American Cement Tile Manufacturing Company**, Pittsburgh, Pa., which deals with every phase of the three distinct types of Bonanza cementile roofing manufactured by this company. Of the 76 pages included in the catalog, the first 40 pages are devoted almost entirely to construction and actual installation views of the various types of cementile roofing. The remaining 36 pages are made up of specifications, data, and detail sheets, showing the application of cementile to the various types of roof construction. The company has also published a supplementary catalog made up entirely of specifications and detail sheets, designed primarily to be of service to engineers, architects and draftsmen.

Personal Mention

General

A. F. Manley, roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Mobridge, S. D., has been promoted to trainmaster, with headquarters at St. Maries, Idaho.

Mark C. Williams, assistant superintendent on the Oregon-Washington Railroad & Navigation Company, and an engineer by training and experience, has been promoted to superintendent of the Third Division, with headquarters at Spokane, Wash. Mr. Williams was born in August, 1882, at Delaware, Ohio, and was educated at the University of Denver and the University of Colorado. He entered railway service in 1901, prior to entering college, as a rodman on location surveys for the Denver & Salt Lake. After completing his college course he became a draftsman on the Oregon-Washington Railroad & Navigation Company and during the period from that time to 1914 was promoted successively to transitman, locating engineer and resident engineer on the location of that company's lines in Washington. On February 1, 1914, he was promoted to division engineer, with headquarters at Walla Walla, Wash., and on June 1, 1917, was transferred to the First Division, with headquarters at Portland, Ore. Mr. Williams entered the operating department as assistant superintendent of the First Division, with headquarters at Portland, on April 1, 1926, which position he was holding at the time of his recent promotion to superintendent of the Third Division.

Engineering

C. L. Bates, formerly of the engineering department of the Pacific Great Eastern, has been appointed maintenance of way engineer of that road with headquarters at Vancouver, B. C.

Charles E. Beveridge, whose appointment as engineer maintenance of way and structures of the Utah Railway was noted in the January issue, was born on September 5, 1887, at Mattoon, Ill., and graduated from the University of Illinois in 1910. Mr. Beveridge entered railway service as a rodman on the Union Pacific during his college course and again served in the same capacity in 1909. On April 12, 1913, he entered the service of the Union Pacific as an instrumentman on the map surveys and from February, 1914, to March, 1916, was instrumentman and material clerk on the enlargement and concreting of the Aspen tunnel. In March, 1916, he became a draftsman and estimator in the office of the division engineer at Green River, Wyo., and continued in that position until June, 1923, with the exception of four months in 1920, when he was acting roadmaster between Bitter Creek, Wyo., and Green River. In June, 1923,

he was promoted to assistant engineer, in which capacity he was engaged in the enlargement and concreting of tunnels and the location and construction of pipe lines, reservoirs and other water facilities, and which position he was occupying at the time of his appointment as engineer maintenance of way and structures of the Utah Railway. Mr. Beveridge's headquarters are at Martin, Utah (post office, Helper, Utah), instead of at Price, as stated in the January issue, although his residence is at Price.

Robert Faries, superintendent of the Buffalo division of the Pennsylvania, with headquarters at Buffalo, N. Y., has been promoted to assistant chief engineer of maintenance with headquarters at Philadelphia, Pa., to succeed **George W. Snyder II**, notice of whose death was published in the February issue. **J. M. Fair**, division engineer in the office of the general manager of the Pennsylvania, with headquarters at Philadelphia, Pa., has been transferred to the Buffalo division, with headquarters at Buffalo, N. Y., succeeding **R. P. Graham**, who has been transferred to the Middle division with headquarters at Altoona, Pa.

F. H. Hibbard, whose promotion to engineer of the Quebec Central, with headquarters at Sherbrooke, Que., was noted in the February issue, entered the service of this company on June 1,



F. H. Hibbard

1913, as engineer in charge of construction, prior to which time he was resident engineer of construction of the Transcontinental Ry., and later joined the engineering staff of the Lake Erie and Northern, with which company he remained until entering the service of the Quebec Central in 1913. In 1916 he became assistant engineer and on January 1, 1924, was appointed engineer maintenance of way, which position he held until his recent promotion.

Elbert H. Dresser, whose appointment as chief engineer of the Duluth, Missabe & Northern, with headquarters at Duluth, Minn., was noted in the February issue, was born on October 9, 1878, at Jefferson, Iowa, and was educated at Rensselaer Polytechnic In-

stitute. He entered railway service in September 1889, in the engineering department of the D. M. & N., where he was advanced to division engineer, leaving to enter military service in 1918. On his return to civil life in



Elbert H. Dresser

1919, Mr. Dresser engaged in the general contracting business in the Ranger district in Texas and in the following year became president of the Polaris Concrete Products Company, which position he was holding at the time of his appointment as chief engineer of the D. M. & N. on January 16.

Charles E. Adams, whose promotion to division engineer of the St. Louis division of the Pennsylvania, with headquarters at Terre Haute, Ind., was noted in the February issue, was born on October 7, 1891, and was educated at the Ohio State University. Mr. Adams entered railway service as a crossing watchman prior to attending college and also served in various clerical capacities. In June, 1912, after leaving college, he entered the engineering department of the Pennsylvania on the Richmond division and was transferred successively to the Cincinnati and Akron divisions, where he had charge of construction work. In May, 1920, he was promoted to supervisor on the Akron division, with headquarters at Akron, Ohio, and was transferred successively to the Buffalo division at East Aurora, N. Y., and to Rochester, Pa. Mr. Adams was serving as supervisor at the latter place at the time of his recent promotion to division engineer of the St. Louis division.

George K. Thornton, assistant to the engineer maintenance of way of the Boston & Maine, with headquarters at Boston, Mass., has been promoted to engineer of track, with headquarters at the same place, and **John P. Canty**, division engineer of the Fitchburg division, with headquarters at Greenfield, Mass., has been promoted to assistant to the engineer maintenance of way, with headquarters at Boston, to succeed Mr. Thornton. **Henry C. Archibald**, supervisor of bridges and buildings, with headquarters at Salem, Mass., has been promoted to acting

division engineer of the White Mountains-Passumpsic division, at Woodsville, N. H., to succeed **Robert H. Parke**, transferred to the Portland division at Salem, Mass., succeeding **Timothy G. Sughrue**, who has been transferred to the Terminal division at Boston to replace **Samuel P. Coffin**, who in turn has been transferred to the Fitchburg division at Greenfield to succeed Mr. Canty.

Mr. Canty was born on August 25, 1865, at Portsmouth, N. H., and after graduating from Dartmouth College in 1890, he entered the service of the Boston & Maine as a bridge draftsman, serving in this capacity until 1893, when he became a bridge inspector. From 1896 to 1899 he was an assistant engineer, and was then made general foreman of bridges and buildings. In 1900 he was promoted to supervisor of bridges and buildings, and in 1911 to superintendent of bridges and buildings, which position he held until 1913, when he was again made supervisor bridges and buildings. Mr. Canty was promoted to division engineer in 1918, and held this position until his recent promotion to assistant to the engineer maintenance of way.

Track

O. Haanes, section foreman on the Chicago, Milwaukee, St. Paul & Pacific, has been promoted to roadmaster, with headquarters at Marmath, N. D., to succeed **P. Burns**, who has been transferred to Mobridge, S. D., to take the place of **A. E. Moxness**, transferred to Marmath, N. D., to take the place of **O. Miller**, who has been transferred to Mobridge to take the place of **A. F. Manley**, whose promotion to trainmaster, with headquarters at St. Maries, Idaho, is noted elsewhere in this issue.

E. J. Dowdell, section foreman of the yard at Trenton, Ont., on the Canadian Pacific, has been promoted to roadmaster, with headquarters at Havelock, Ont., to succeed **R. H. Milliken**, who has been transferred to Trenton to replace **W. H. Noyes**, transferred to the Toronto Terminals division to succeed **W. Code**, who has retired on a pension after 48 years' service. **A. Partushek**, section foreman at Shawanaga, Ont., has been promoted to roadmaster on the Temiskaming subdivision of the Algoma district, with headquarters at Mottawa, Ont., to replace **E. McCrea**, who has been transferred to the North Bay subdivision, with headquarters at the same point, to succeed **A. J. Seal**, resigned.

John Christenson, whose promotion to roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Belleville, Kan., was noted in the January issue, was born on January 21, 1880, at Bergen, Norway. Mr. Christenson entered railway service on June 1, 1898, as a section laborer on the Rock Island and was promoted to section foreman on January 1, 1903. He was promoted to extra gang foreman on April 26, 1905, and served in that capacity until August 25, 1907, when

he resumed his position as section foreman. He was promoted to yard foreman at Limon, Colo., on May 1, 1910, and on May 8, 1921, was transferred to Rosewell, Colo., where he was located at the time of his recent promotion to roadmaster.

Alfred E. Perlman, whose promotion to roadmaster on the Northern Pacific, with headquarters at Carrington, Minn., was noted in the January issue, was born on November 22, 1902, at St. Paul, Minn., and graduated from the Massachusetts Institute of Technology in 1923. He entered railway service in June, 1918, as a clerk on the Minneapolis, St. Paul & Sault Ste. Marie during his school vacation, and during his vacations in subsequent years served in various capacities on the railways in Minneapolis. On July 7, 1923, he became a field draftsman on construction on the Northern Pacific, and on July 11 of the following year entered the maintenance department of that road as a track laborer. He was promoted to inspector of icing facilities on March 1, 1925, and was further advanced to inspector of bridges and buildings on February 15, 1926, which position he was holding at the time of his recent promotion to roadmaster.

Lloyd Dippert, whose promotion to roadmaster on the Chicago & North Western, with headquarters at Lusk, Wyo., was noted in the January issue, was born on March 28, 1896, at Ft. Robinson, Neb., and entered railway service as a section laborer on the North Western at that place on June 30, 1918. He was promoted to section foreman at Dakota Junction, Neb., on April 1, 1919, and was transferred to Andrews, Neb., May 3, 1920. Mr. Dippert was promoted to temporary assistant roadmaster, with headquarters at Lusk on March 16, 1923, serving in this position until November 15 of the same year, when he resumed his duties as section foreman at Andrews. During the following year he was again promoted to temporary assistant roadmaster at Lusk for the period from April 1 to November 1. On the termination of this service he resumed his position of section foreman at Andrews which position he was holding at the time of his promotion to roadmaster.

Raymond W. Davis, whose appointment as roadmaster on the Fargo division of the Northern Pacific, with headquarters at East Grand Forks, Minn., was noted in the January issue, was born on October 20, 1895, at St. Paul, Minn. After attending the University of Minnesota he entered railway service October 12, 1916, as a chainman on the Northern Pacific and served in this capacity and as a rodman until July 1, 1917, when he entered the United States Army. On his return to civil life in December, 1918, he resumed his position as a rodman on the N. P., where he remained until May 1, 1921, when he was made an assistant engineer in the Minnesota State Highway Department. On July 1, 1922, he became an inspector on

washed gravel ballast operations on the N. P., and on May 1, 1925, was promoted to assistant roadmaster on the Fargo division of the same work. On September 12, 1926, he was appointed assistant supervisor of bridge and buildings on the same division and was holding this position at the time of his recent promotion to roadmaster.

H. R. Meintel, assistant supervisor on the New York division of the Pennsylvania, with headquarters at Trenton, N. J., has been transferred to the Allegheny division to succeed **C. J. Code**, promoted to supervisor on the Middle division, with headquarters at Tyrone, Pa., to replace **J. C. White**, whose promotion to division engineer of the Richmond division, with headquarters at Richmond, Ind., was noted in the February issue. **G. R. Emery**, assistant supervisor on the Maryland division at Perryville, Md., has been promoted to supervisor on the same division, with headquarters at Media, Pa., to succeed **C. W. Newell**, who has been furloughed on account of ill health. **F. M. Oyler**, assistant supervisor on the Pittsburgh division, with headquarters at Gallitzin, Pa., has been promoted to supervisor on the Monongahela division, with headquarters at West Brownsville, Pa., to succeed **W. W. Patchell**, transferred to the Pan Handle division at Steubenville, Ohio, to take the place of **H. R. Rockenbach**, who has been transferred to the Eastern division, with headquarters at Rochester, Pa., to succeed **C. E. Adams**, whose promotion to division engineer of the St. Louis division, with headquarters at Terre Haute, Ind., was noted in the February issue. **H. Kooser**, assistant on engineer corps, has been promoted to assistant supervisor on the Buffalo division, at Buffalo, N. Y., succeeding **L. B. Woods**, who has been transferred to the Pittsburgh division at Gallitzin, Pa., to succeed Mr. Oyler. **Frank E. Condon**, track foreman, has been promoted to supervisor on the Chicago terminal division, to take the place of **D. Delaney**, transferred. **C. E. Gray** has been appointed supervisor on the Conemaugh division, with headquarters at Blairsville, Pa., succeeding **C. F. Trowbridge**, transferred to the Eastern region.

Bridge and Building

Lawrence M. Farley, whose promotion to chief carpenter of the Dubuque division of the Chicago, Milwaukee & St. Paul (now the Chicago, Milwaukee, St. Paul & Pacific), was noted in the January issue, was born on June 5, 1888, at Bird City, Kan., and entered railway service in July, 1907, as a laborer in an extra gang on the Kansas City division of the C. M. & St. P. He entered the bridge and building department on July 9, 1909, where he served successively as laborer, carpenter's helper, pile driver deck hand and carpenter until 1916, when he was promoted to foreman, which position he was holding at the time of recent promotion to chief carpenter.

John R. Morphew, whose promotion to supervisor of bridges and buildings on the Illinois Central, with headquarters at Ft. Dodge, Iowa, was noted in the January issue, was born on December 29, 1873, at Nora Springs, Iowa. He entered railway service on February 5, 1895, as a bridgeman on the Illinois Central and was promoted to assistant foreman in March, 1901. He was further promoted to foreman on steel erection in February, 1904, and in August, 1916, he was promoted to bridge inspector on the Northern and Western lines, which position he was holding at the time of his recent promotion to supervisor of bridges and buildings.

Purchasing and Stores

A. E. Walters, division storekeeper on the Illinois Central, with headquarters at Memphis, Tenn., has had his jurisdiction extended to include all materials and supplies on the Mississippi division, succeeding **G. D. Tombs**, whose headquarters were at Water Valley, Miss., and who has been assigned to other duties.

Obituary

Joseph Lindsey, former division superintendent on the Great Northern, who was a master carpenter at various points on that road before entering the operating department, died on December 24, at Superior, Wis., at the age of 68 years.

K. S. Hull, division superintendent on the Gulf, Colorado & Santa Fe, with headquarters at Temple, Tex., whose early railway training was in the maintenance of way department, died January 30 at Temple from wounds received when he was shot by a discharged employee, who then committed suicide.

Malcom H. McLeod, formerly vice-president of construction of the Canadian National, with headquarters at Toronto, Ont., died in that city on February 8 from heart disease. Mr. McLeod was born on July 13, 1857, at Isle of Skye, Inverness county, Scotland, and entered railway service in 1878 as a rodman on the Credit Valley (now a part of the Canadian Pacific), later serving as an assistant engineer on construction and as a locating engineer on various Canadian railways. From 1894 to 1896 he was engineer in charge of the location and construction of the Lake Temiscamingue Colonization Railway (a branch of the Canadian Pacific), and from 1897 to 1898 was locating engineer, assistant chief engineer and superintending engineer of the Crow's Nest Pass branch of the Canadian Pacific, following which he was chief engineer and superintendent of the Crow's Nest Pass division of the same road. In 1909, Mr. McLeod became chief engineer of the Western lines of the Canadian Northern (now a part of the Canadian National) and in 1907 was appointed also general manager of the same lines, continuing in this position until 1918,

when he was promoted to vice-president of the Canadian National. Mr. McLeod was appointed vice-president of construction in 1920 and in 1923 was appointed consulting officer to the executive, which position he was holding at the time of his retirement in August, 1925.

Willard Beahan, special engineer for the Erie and the New York, Chicago & St. Louis, with headquarters at Cleveland, Ohio, died at Alma, Mich., February 5. Mr. Beahan was born on January 15, 1854, at Walkins, N. Y., and graduated from Cornell University in 1878, later entering the service of the United States engineering corps, with which he was engaged for one year in Missouri. Following this he entered railway service with the Texas & Pacific where he remained for a period of about ten years and was advanced to division engineer. From 1890 to 1905, Mr. Beahan served as division engineer on the Lehigh Valley; as superintendent of construction on the Cascade tunnel of the Great Northern in Washington; as general superintendent of streets for the city of St. Louis, Mo.; as president of Anderson & Barr, contractors, and as division engineer on the Chicago & North Western. During the same period he went to South America with the North and South American Construction Company on the construction of railways for the Chilean government. In 1905 he became first assistant engineer on the Lake Shore &

Mr. Felt was born on April 29, 1864, at Salem, Mass., graduated from the Massachusetts Agricultural College in 1886. He entered railway service in the same year as an axeman on construction on the Santa Fe in Kansas and Colorado and later was advanced to rodman and to bridge engineer. He became a levelman on the Denver & Rio Grande (now the Denver & Rio Grande Western) in 1888, and for the next five years was successively instrumentman on the Arizona & South-



Charles Frederick Wilson Felt

eastern (now a part of the Southern Pacific); transitman on the Topolobampo Line in Mexico, resident engineer on the Gulf, Colorado & Santa Fe at Cleburne, Tex., and office engineer on the Rio Grande Southern. In February, 1893, Mr. Felt returned to the G. C. & S. F. as a division engineer, and in the same year was appointed resident engineer at Galveston, Tex. He was promoted to chief engineer in September, 1896, and on November 6, 1909, he was promoted to chief engineer of the Eastern and Western lines of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan. He was further promoted to chief engineer of the system on April 1, 1913, which position he was holding at the time of his death. Mr. Felt had long been closely connected with the work of the American Railway Engineering Association, of which he was a charter member, serving for six years as a director and as president in 1926-1927.



Willard Beahan

Michigan Southern (now the New York Central) at Cleveland, Ohio, in which position he remained until 1924, when he entered the service of the Nickel Plate as special engineer in charge of location work on the Clover Leaf district. More recently he has acted in special consulting capacities for both the Nickel Plate and the Erie, in which capacity he was acting at the time of his death.

Charles Frederick Wilson Felt, chief engineer of the Atchison, Topeka & Santa Fe System, with headquarters at Chicago, died on February 4 at Colorado Springs, Colo., after an extended illness which caused him to take a leave of absence in November, 1926.

The Canadian Railway Club has offered a prize for the best paper, not over 4,000 words in length, on employee education, the competition being open to all members of the club and employees of any transportation company in Canada holding positions under that of general foreman or chief clerk. The writer's name must be sent in on a slip of paper separate from the article itself and the essay must be in the hands of the secretary not later than May 1. The prize is a course in the International Correspondence School, Scranton, Pa., or \$45 in cash, at the option of the winner.

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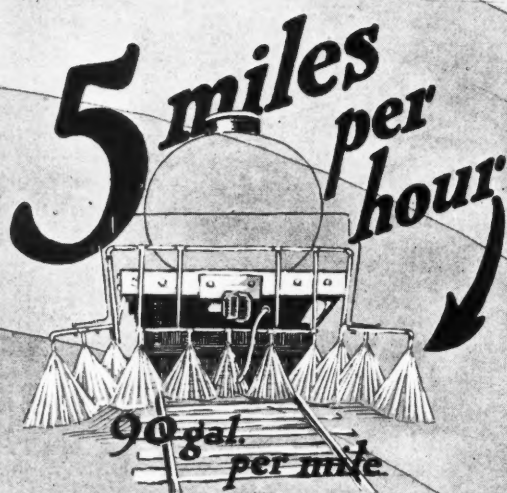
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When the train travels at *slow speeds*, a comparatively small amount of weed killer is discharged per minute. When traveling at *fast speeds* an amount proportionately larger to properly dose the weeds is sprayed. With this equipment *precision* methods in applying weed killer are possible, as the amount sprayed is in gallons per mile — not gallons per *minute*.

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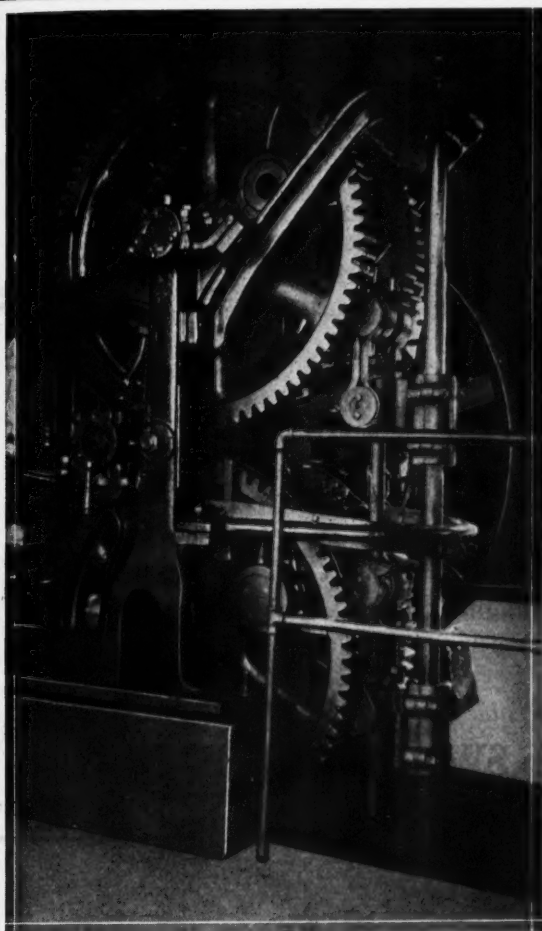
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Exclusive Anchor Features: (1) U-bar Line Posts. (2) Square Terminal Posts. (3) Drive Anchorage. (4) Wire-Weld Gates.

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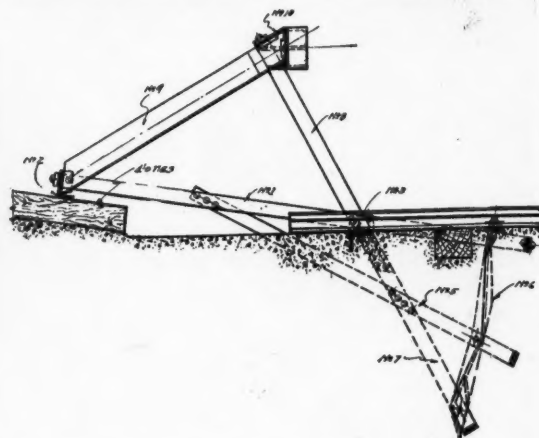
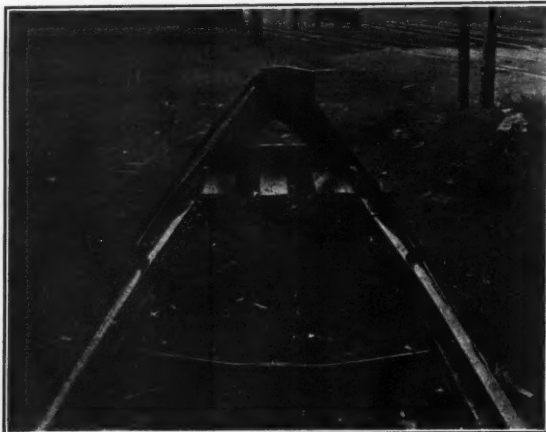
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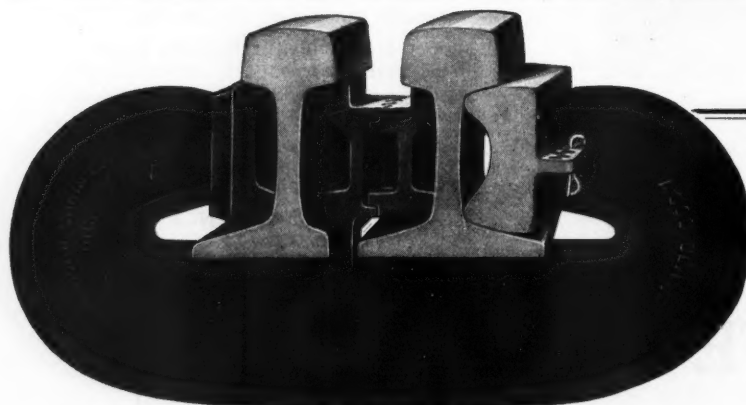
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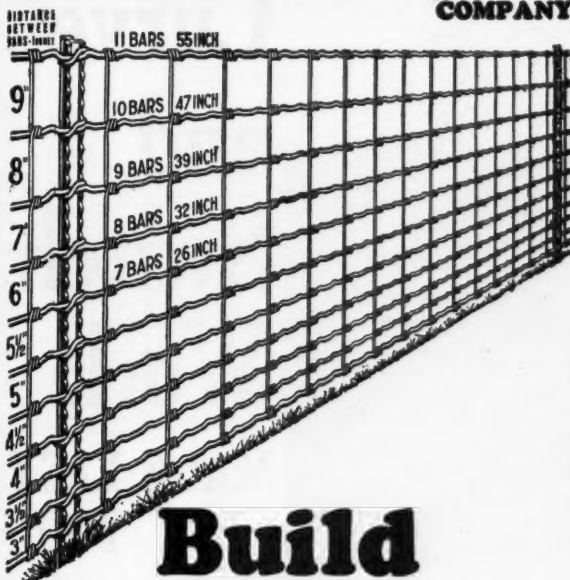
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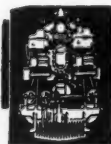
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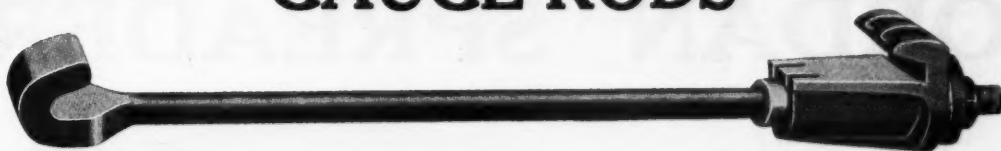
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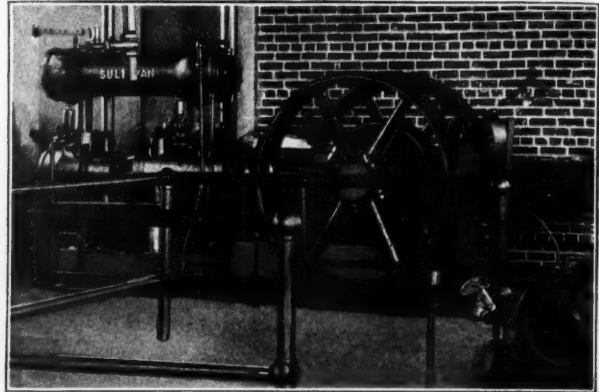
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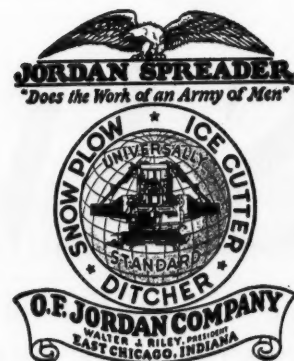
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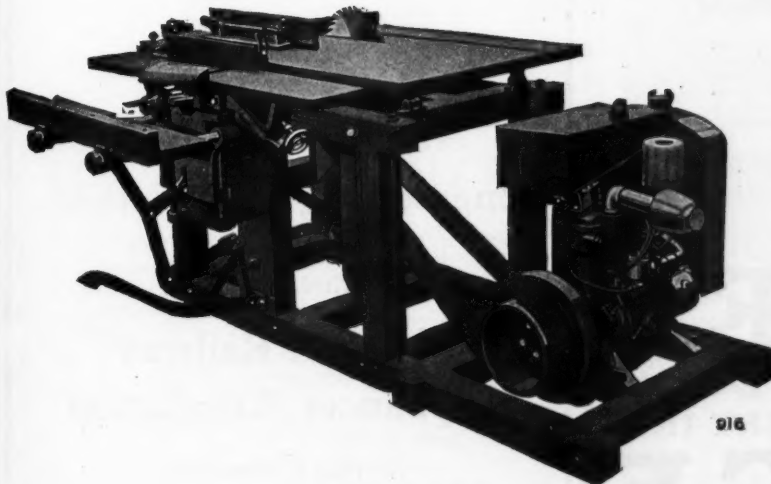
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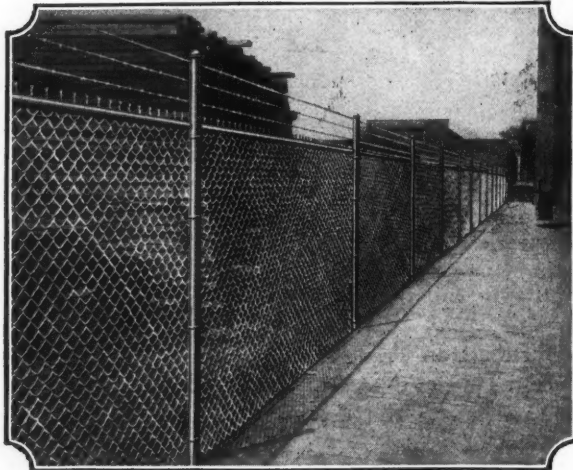
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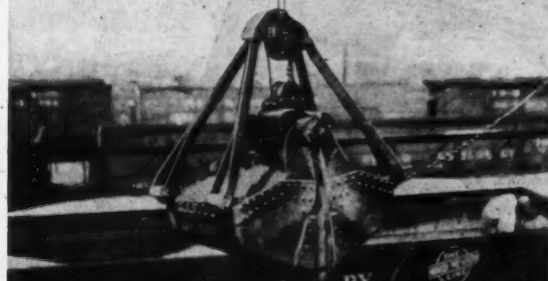
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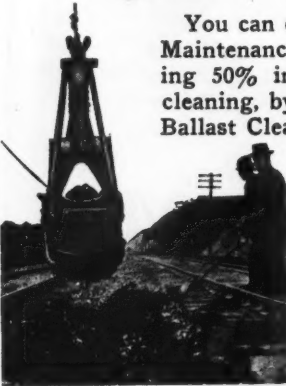


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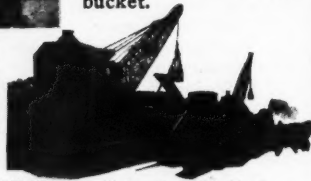


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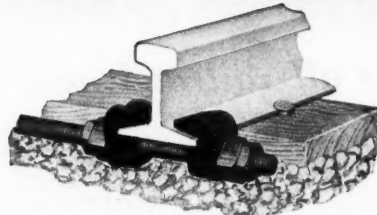
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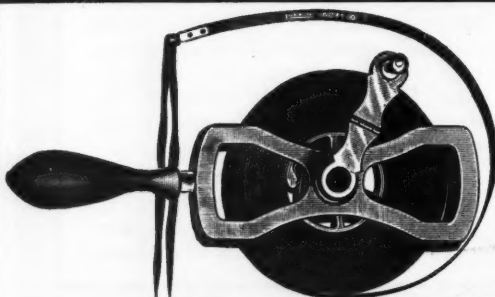
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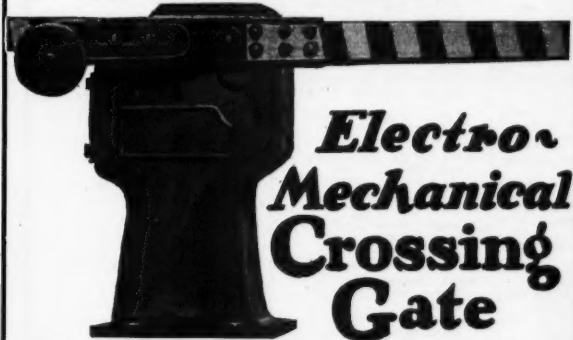
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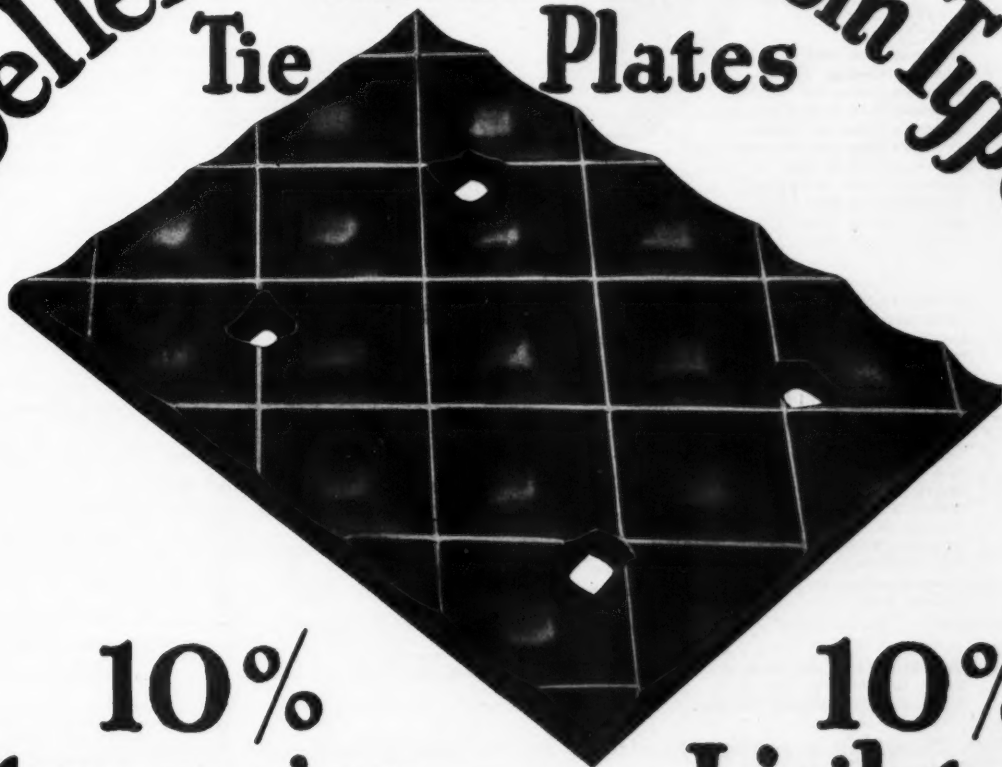
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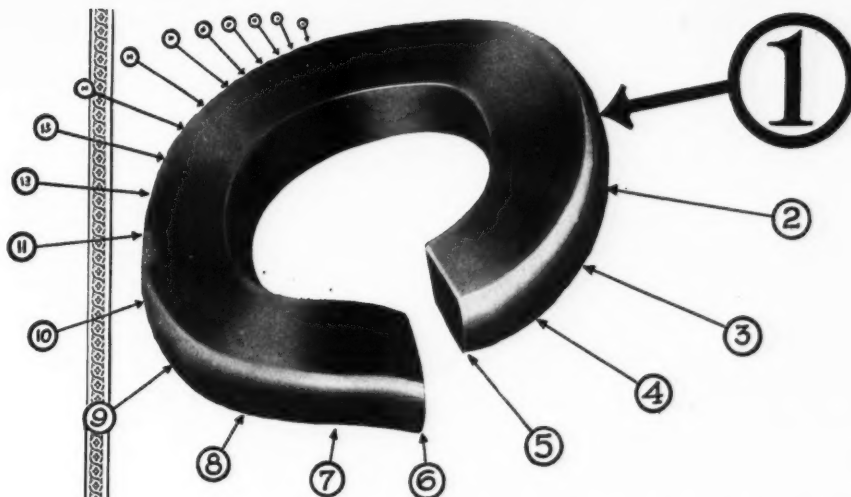
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There Are Many Points of Improved Hipower Superiority.
This is point of superiority Number 1.

LEADERSHIP

OVER twenty years ago we advocated to the railroads of this country the adoption of a drastic new theory pertaining to the proper functioning of spring washers, then termed nut locks. The immediate response was none too encouraging.

Six years ago we brought out **IMPROVED HIPOWER**—a device incorporating the principles necessary to the successful application of our theory.

Today our original theory is accepted as official by practically every railway executive—its essentials have been embodied in every railroad and association specification.

In over twenty years our fundamental principles of spring washer efficiency have never varied. The adoption of **IMPROVED HIPOWER** by the bulk of America's railroads has revolutionized the entire industry.

RETARDS WEAR MORE THAN ANY OTHER SPRING WASHER

UNLIKE contemporary devices, **IMPROVED HIPOWER** is designed primarily to retard the wear of track joint parts rather than merely to compensate for the wear after it occurs.

It does adequately compensate for the semi-looseness caused by inevitable wear but that feature is secondary.

The aim and ideal of all railway engineers is tight bolts that stay tight. **IMPROVED HIPOWER** with its tremendous reactive strength maintains this initial tightness longer than any device on the market. Our constantly increasing sales clearly indicate that its success is well organized.

To attempt to only compensate for looseness is illogical—it's like locking the stable door after the horse is stolen.

The **IMPROVED HIPOWER** design—superimposed curves on the normal spiral—alone has the stiffness to achieve the desired end.

There are many other points of superiority. Our advertisements will announce them.

The National Lock Washer Company
Newark, New Jersey, U. S. A.

IMPROVED
HIPOWER
Commercially Non-flattenable • • Permanently Rust-Proof



They shorten the line at the pay car

VERONA Rail Joint Springs do away entirely with the necessity for periodical bolt tightening.

With this task eliminated, track can be maintained with considerably fewer men. Thus your smallest item of equipment—a nut-locking device—cuts down your biggest item of maintenance—labor. You pay for the equipment once; but you pay for the labor daily.

Labor is not the only saving effected by permanently tight joints. They save rail ends and splice bars and ties, and the staggering cost of wrecks, derailments, and delays.

But quite apart from these items, important though they may be, Verona Rail Joint Springs save their cost many times merely through shortening the line at the pay car.



VERONA TOOL WORKS

Pittsburgh, New York, Chicago, St. Louis, San Francisco
New Orleans, Washington, St. Paul, Baltimore

